SEVENTY-FOURTH YEAR

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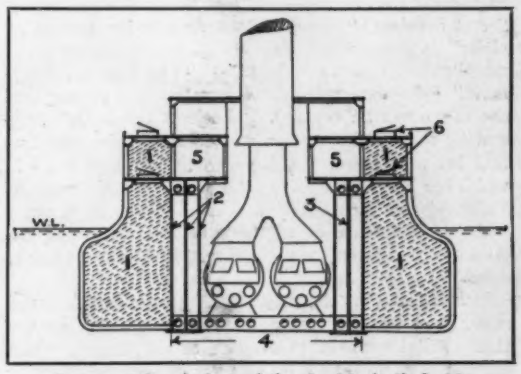
A Ship Within a Ship

THE Italian merchant marine is not sufficiently numerous to withstand many losses without suffering a very serious diminution. Not long ago, a hostile submarine sent the "Milazzo" of 11,477 tons gross, to the bottom. The ship was put in service as recently as 1916, and marked a notable departure in bulk cargo freighters. Similarly, a U-boat, a short while back, sent to her grave the "San Guglielmo," of 8,341 tons gross, of the well-known Sicula-Americana Line. Thus the enemy underwater craft have been making dire inroads upon Italy's ships of commerce. It is, therefore, easy to realize just why the Government appointed a special committee to consider plans for types of ocean-going merchantmen better able to withstand torpedo attack.

It has recently been announced that this committee has concluded its work after deciding upon a design capable of meeting the specified requirements and susceptible of speedy construction upon standardized lines. Just what the nature of this type is has not been disclosed, but, in all likelihood, it is probably that developed by Naval Constructor Umberto Pugliese, which occasioned a great deal of favorable comment in Italian technical journals a few months ago. Accordingly the following particulars about the Pugliese anti-submarine freighter should be of present interest.

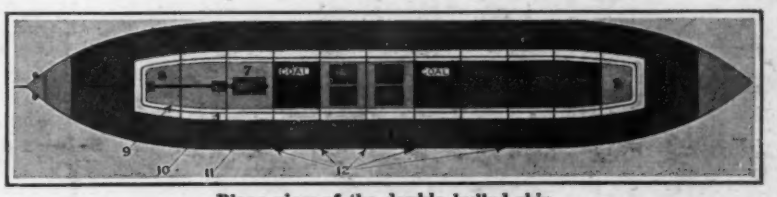
The whole problem of how best to neutralize the ravages of the U-boat has been investigated at some length both here and abroad, and the plans offered may be broadly divided into two classes. The first involved protective features that curtailed the cargo-carrying capacity, while the second, because of greater speed of construction and comparative simplicity of design, promised more numerous fleets, able to transport full cargoes, and thus offsetting by numbers the net sacrifices. In other words, the first class, although damaged, would probably be able to make port: those of the second class, being without structural defense, would in all likelihood sink if hit, but enough of them would get through to strike a fair average in the matter of freight delivered.

Italy, with her limited deposits of iron ore and her dependence in the main upon imported coal, is extremely hampered in the matter of domestic steel, and on that account her designers have sought to meet this situation, now that it is so difficult to obtain structural materials abroad, by evolving a defensive type of merchantman that would in this way minimize the effect of the foe's submarine activities. In brief, the controlling keynote in the elucidation of the problem for the Italians has been that of most practical conservation. Engineer Pugliese has taken as a basis for his design the familiar cargo type known to the shipping world as the "turret" steamer—really an improved order of the whaleback vessel which originated in the United States in the early "nineties." Internally, however, the Italian naval architect has made changes which he is confident will greatly reduce the menace both of the submarine mine and the automobile torpedo. His plan calls for cargo carriers ranging from 10,000 to 12,000 tons displacement, of 10 to 12 knots, capable of transporting from 4,500 to 5,500 tons of freight, respectively. The 10,000-ton steamers would be 395 feet long, and when full laden would draw something less than 16.5 feet, as against the 22-foot draft of an ordinary craft of identical displacement. The purpose of this reduced draft is to lessen the chance of a torpedo—set to run at a normal depth of 14 feet—hitting its target and, likewise, reducing the probability of the freighter stumbling upon submarine mines planted at a predetermined depth.



Cross-sectional view of the double-hulled ship

1. Primary cargo spaces. 2. Longitudinal bulkheads. 3. Principal defensive longitudinal bulkhead. 4. Span of double bottom. 5, 5. Fore-and-aft passage. 6. Cargo hatches and gas vents.

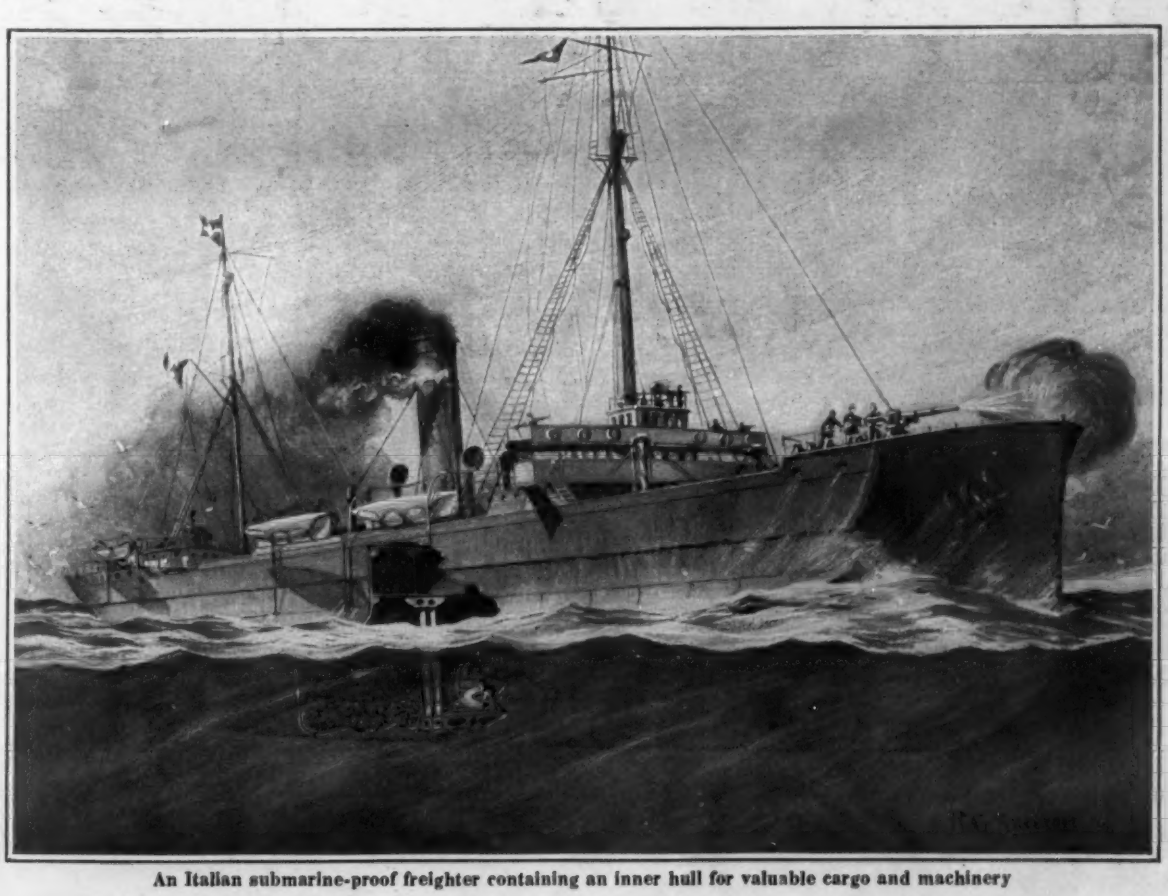


Plane view of the double-hulled ship

1, 1, 1. Compartments for the primary stowage of bulk cargo. 2, 2, 2. Secondary freight hold. 6, 6. Boiler rooms. 7. Engine room. 8, 8. Magazines. 9. Inner longitudinal bulkhead. 10. Middle or principal defensive longitudinal bulkhead. 11. Outer longitudinal bulkhead. 12. Athwartship bulkheads.

If the torpedo be adjusted to run nearer the surface—say at a depth of five feet, its explosive violence would be greatly sapped by the shallower stratum of water lying above the weapon. In other words, the tamping effect of the superposed water would be cut down nearly two-thirds, and the destructive gases would find a correspondingly easier path of dissipation upward instead of horizontally and inward upon the body of the ship. Engineer Pugliese counts upon the character of the bulk cargo to absorb the shock and to lower rapidly the temperature of the rending gases, and then by suitable vents through the two decks above, to open further channels of escape. It will be noticed that there is no double bottom under the outboard cargo compartments at the points where mines would be most likely to hit. The freight stowed there would, if displaced by the blast, be more freely lifted than disturbed laterally, and, upon this assumption, the superheated gases would find their line of least resistance upward and through the large deck vents, which, in fact, are designed to serve as loading hatches. It will also be observed that the outboard stowage of freight is carried up to the main deck, and this disposition of the bulk cargo provides a potentially effective bulwark against shell attack from the guns of a submarine operating upon the surface. Likewise, the complete athwartships stowage of cargo forward and abaft of the vital area furnishes what is calculated to be a shield against a raking fore-and-aft fire.

Should, however, either the torpedo or the mine have force enough to spread its destructive work horizontally and athwartships, then the gases will meet a triple defense in the form of three parallel bulkheads, together providing two air spaces having a total width of substantially 53 inches. Inside of this barrier are placed the vitals in the shape of boilers, engines, and stores.



An Italian submarine-proof freighter containing an inner hull for valuable cargo and machinery

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The object of this journal is to record accurately and lucidly the latest scientific, mechanical and industrial news of the day. As a weekly journal, it is in a position to announce interesting developments before they are published elsewhere.

The Editor is glad to have submitted to him timely articles suitable for these columns, especially when such articles are accompanied by photographs.

The War Behind the Front

GERMANY continues to carry on the war, not because she believes she can obtain a military decision at the front, but because she hopes to win a victory against the morale of the civil population behind the front. Her chance of a military decision slipped out of her hands long ago. In 1914 when she set a rear guard of Reservists at her back door on the Russian front, and hurled the flower of her Army against France, Germany believed she had a firm grip upon that world victory which was to be the fruition of 40 years of preparation; but Joffre pried the Prussian fingers loose at the Marne, and at Verdun and the Somme the French and British tore the coveted victory entirely from her grasp. From those days to these the German General Staff have known that their dream of a military victory has passed into the realm of things that might have been.

The impossibility of a German victory—German threats of a great spring offensive notwithstanding—becomes clear if we look at a few simple facts. Thus, when the Allies hurled the German Army back at the Marne, France had 1,500,000 men in the fighting line and England a scant 100,000. Such forces as they had were outnumbered in the ratio of five to three; and they were outranged in artillery and outnumbered and outwatched in all the things that go to make up military equipment.

Since the Marne, the French Army at the front has grown from 1,500,000 to 3,000,000 and the British Army from 100,000 to 2,500,000. In 1914, the United States was a spectator of the conflict; but by the time the great German offensive (should it ever come off), is in full swing we shall have several hundred thousand men at the front. In 1914, Germany had a potential army of 9,500,000 men—today, one-half of that number has been killed, captured, permanently crippled or is dead from natural causes, with the result that, on the western front, the numerical superiority has passed from Germany to the Allies, who can oppose over 6,000,000 men to a maximum of 4,500,000 German troops. In the matter of artillery there is an equal preponderance on the Allied side. Last, and by no means least important, is the fact that what is left of the German Army contains a far larger proportion than the Allied armies of men who, by reason of age and immature youth, are ill suited to stand the terrific strain of modern warfare. Nor should we in this comparison forget that while in the German Army there has been a noticeable decline in morale, due to the pinch of want and the sickness of heart which comes from endless promises that are unfulfilled, the morale of the Allied Armies, who are well fed, steadily increasing in strength, and cheered by some eighteen months of all but unbroken victories from the Swiss border to the North Sea, is uniformly good.

But if Germany despairs of a great military decision in the field, why does she continue to fight? She must be well aware that the prolongation of the brutal war which she is waging deepens the resentment against her, and will make more hard the terms to which she must subscribe when she is forced to admit that she has lost the war.

The answer to this question is to be found in the notable successes which Germany has won in that field of conflict back of the front where she is a far more skilled antagonist than she has ever been in the sphere of military operations. We refer, of course, to that world-wide war—secret, subtle, deadly and enormously effective, which she is ceaselessly waging among the civilian populations back of the military fighting lines of the Allies. Here she has won victories more complete, of greater significance, and with infinitely more disastrous consequence to her enemies, than any which she has won in the field. Witness the complete collapse of Russia and the partial collapse, in the fall of last year, of the hitherto indomitable Italian Armies.

Germany's hope of victory lies in the war behind the front—a war which in its secrecy and cunning is as deadly and difficult to deal with as the sub-sea piracy of the German U-boats. It was after Germany realized that she could never win on the sea and in the open, that she struck below the sea and in the dark. So, realizing that she can never conquer with the sword, she seeks to win out against the non-combatant's population by means of the subtle suggestion of failure, the secret whisperings of disaffection, the little spark of rumor which runs through men's minds like fire through dry stubble, to say nothing of the deliberate lie, craftily conceived, cunningly camouflaged, and whispered by a thousand trusted spies into ten thousand listening ears.

In carrying on this war there is no weapon, however small, that is so insignificant as to be overlooked by the German propagandist; there is no influence which can have the slightest effect upon the morale of the people that is considered too small for the patient, tireless effort of these soldiers of secrecy in our midst, whose efficiency increases in the ratio of their modesty and apparent insignificance. Many are the current phrases which have originated in the secret text books of the German Secret Service: "Peace without Annexation or Indemnities" (a peace which involves no acknowledgment of moral guilt by the vanquished). "The War Is a Stalemate" (which suggests that Germany is so strong that she can never be beaten). "Look at the Map" (suggesting that Germany has won, and ignoring the fact that her man power has decreased in the proportion in which her boundaries have extended). "Peace without Victory" (the most insidious phrase of all; for a peace without confession of military defeat, would be acclaimed by Germany as a peace won by German force of arms.)

It is a fact that the majority of people in this world never grow up, and that only a small minority develop that mental growth, that sense of proportion, which enables them to take a broad view of such far-reaching questions as are involved in this world war. Most people are intelligently concerned only with the things which are close at hand and readily obvious. They look, as it were, through a knot-hole instead of using the sixty-degree angle of vision which every intelligent man ought to have; and consequently such people, and it is the great majority, are peculiarly sensitive to the suggestions of a propaganda, which is as subtle and difficult to detect as it is all-pervading and pernicious. The large majority of the rumors of disaster to our troops; of discomforts, sicknesses, and deaths in the cantonments; of delays, disorganization, and even of graft in the great war industries, are of enemy origin. And the pity of it all is that, unconsciously, there are thousands of well-meaning citizens who, because they have an ill-regulated appetite for the scandalous and the shocking, assist this enemy propaganda by repeating the enemy rumors, too often with embellishments of their own.

Without shutting his eyes to defects or foregoing his inalienable right to criticism, it is the duty of every citizen to cultivate in these times of stress a spirit of healthy optimism. "Thoughts are things." A lie persistently repeated and idly passed on, even though we believe it to be a lie, begins, by virtue of its constant reiteration, to take on in our minds a color of truth.

Therefore, it is the duty of every true patriot among us, whenever he stumbles upon one of these calamity howlers, to ask him at once for his authority, and bring it sharply to his mind, that, whether he intends to or not, he is actively aiding the enemy in his attempt to shatter the morale of the civilian population back of the fighting line.

Alien Crews on Our Merchantships

IN the spring of last year we published two articles on the all-important subject of the manning of our merchant marine, and the urgent necessity for taking the duty of providing crews for our ships out of the hands of the Seamen's Union and placing it in the hands of the Navy.

We knew at that time that the efficiency of our ships was being greatly cut down, because of the poor quality of the general run of seamen with which these ships were being manned; but because of the censorship we refrained from giving certain particulars, which had come to our knowledge.

The facts regarding the inefficient manning of our merchant marine were recited before the House Committee on Naval Affairs by Rear Admiral Leigh Palmer, the Chief of Navigation, and they have now been made public in a speech in the House by Representative Fred C. Hicks, and have been published in the Congressional Record.

To say that the recital of the insubordination, cowardice and general inefficiency displayed by many of the crews is a most disconcerting revelation is to put the matter mildly. If ever watchfulness, courage, discipline, and a high sense of duty are demanded of a ship's crew, surely it is when their ship is traveling amid the multiplied dangers of the submarine zone; yet the recital of facts by Admiral Palmer shows that these are the very qualities in which many of the crews furnished to our ships by the Seamen's Union are utterly deficient.

In order to get first-hand and absolutely reliable knowledge of conditions, Admiral Palmer sent three officers from his Bureau over in charge of the armed guard on the vessels, and they made a report from which the following facts are taken:

On one ship on sailing from New York the storekeeper, lamplighter, boatswain and boatswain's mate were drunk. The crew of this ship, which is a fair sample of the others, was made up almost entirely of foreigners who could not speak even broken English. No disciplinary action was taken in the case of those members of the crew who were under the influence of liquor and were incapacitated for duty. In one case, while in the war zone, the drill known as "abandon ship" had to be held on Sunday. Because of the day, it was necessary to pay the crew 40 cents per hour overtime. Frequently the naval officer who makes this report had to stop members of the engineers' force from smoking on exposed decks at night in the war zone. The offenders could not understand a word of English, and it was necessary for the officer forcibly to extinguish the cigarettes.

Although speed is a main factor of safety in the war zone, during the first hour of each watch, because of the inefficient stoking, speed was reduced from one-half to a full knot per hour. The vessel sailed from New York short about ten to fifteen men, and the captain stated that frequently he sailed with as many as twenty to twenty-five vacancies in the ship's complement. So illiterate and unintelligent was this motly crew, that it was impossible to obtain efficient look-outs while in the war zone. On one occasion, while passengers were being removed to a relief vessel, one of the crew boarded the relief ship from the boat, refusing to return to the torpedoed ship to assist in bringing off the remaining passengers. This man was declared a deserter; but the Seamen's Union took the case up with the steamship company, and the decision that the man was a deserter was overruled.

Representative Hicks quoted several other cases of failure of crews to do their best to save their ships and get them through the submarine zone; and from these we quote the case of a Captain who, on sighting a submarine, although his ship was convoyed, gave orders to abandon ship. The naval armed guard prevented the ship being abandoned, and at the point of the pistol drove the engineer force, including the Chief Engineer, below. The engines were started and the ship resumed her voyage uninjured.

In the course of his speech, Representative Hicks, who is seeking legislation to give the Navy control of the manning of all ships, quoted Andrew Furuseth, President of the Seaman's Union, to the effect that there are about five thousand Germans sailing under the American flag in different capacities. He gave it as his opinion that every officer and every member of a crew navigating a ship in the war zone under the American flag should be an American citizen, and all of them should wear the uniform of his country.

There is a grievous shortage of ships, and it is certain that such as we have should be worked to the full limit of their capacity. They can be rendered fully efficient only if they are manned by the trained seamen of our Navy and subjected to its rigorous discipline. The passage of a law transferring the manning of the merchant marine from the shockingly inefficient control of the Seamen's Union to the highly efficient control of the Navy should be considered one of the very first duties of Congress.

Beginning of the Astronomical Day

AS already mentioned in these columns, astronomers are now debating the question of setting the astronomical day back 12 hours, so as to begin at midnight and coincide with the civil day. A committee of the American Astronomical Society has been appointed to collect expressions of opinion on the subject from astronomers. geodesists, meteorologists, surveyors, navigators, and others. Those who have ideas to offer on this question should address Prof. W. S. Eichelberger, director of the Nautical Almanac, Naval Observatory, Washington, D. C. The arguments are by no means all on one side. Several objections to the proposed plan, from the astronomical standpoint, are set forth editorially in the Publications of the Astronomical Society of the Pacific for December, 1917. Neither is the proposal at all new. It was made in the year 1804 by Laplace, and was agreed to by the French Bureau of Longitudes, though never adopted in the *Connaissance des Temps*. Laplace used the new system in his "Mecanique Céleste," and it was used by a few other French astronomers. The International Meridian Congress which met at Washington in 1884 favored the proposal. A few years later a committee of the Canadian Institute and the Astronomical Society of Toronto, collected opinions on the subject. In 1895 the French Bureau of Longitudes expressed approval of the project, on condition that it should be adopted by other government institutions of the world issuing ephemerides. Universal agreement is a *sine qua non* in this matter.

Aeronautical

The World's Height Record.—Lieut. Papa has beaten his own world's record for high flying with a passenger, says the *Times* Milan correspondent. On an Italian machine he rose to 7,075 meters (23,200 feet), returning to camp after an hour and five minutes' absence. He broke the record last May, rising to 6,435 meters (21,000 feet). Lack of oxygen prevented an even higher flight this time.

Baron von Richthofen's Trophies.—From an illustration appearing in a recent issue of *La Guerre Aérienne* it is gathered that Baron von Richthofen, the well-known German in command of a German fighting squadron or "flying circus," has a special hobby for souvenirs of his combats. The walls of his "den" are decorated with the numbers or distinguishing marks of machines he has shot down, while the chandelier consists of a rotary engine from a victim's machine.

Triplex Glass in Aviation.—The extensive use of triplex glass in aviation is responsible for a low casualty list. Time and again triplex goggles have saved the eyes of aviators and triplex windows or shields have prevented the fliers from sustaining injuries. Recently an airplane fitted with a triplex window struck a tree at 30 feet from the ground, at a speed of 90 miles an hour. It is reported that not a particle of glass was separated from the window by the impact, and the value of this protection to the crew can well be imagined.

Navigation Lights for Airplanes.—For night flying the use of navigation lights is becoming common practice, for the reason that under certain conditions they are practically indispensable. Navigation lights are placed on the edge of the lower plane and are under the control of the pilot in the case of British machines defending London against air raids. These lights serve as a guide to other machines when flying in squadron formation. The German raiders, it appears, also carry navigation lights, and in some cases variegated lights are employed for signaling between the various units of an invading squadron. For landing the British home pilots make use of a flare which is dropped in order to illuminate the ground below.

Commissions for Americans with Lafayette Escadrille.—The Adjutant-General of the Army, acting upon the recommendation of General Pershing, has issued commissions to the following American citizens who have been with the Lafayette Escadrille of the French Army. General Pershing recommended commissions in the Aviation Reserve of the United States Army, and his recommendation was followed by the issuance of commissions as follows: As majors—William Thaw, John F. Huffer and Victor R. Lufbery. As captains—Charles J. Biddle, Phelps Collins, Kenneth P. Littauer, Walter Lovell, David McK. Peterson, Robert Soubiran, Robert L. Rockwell and Kenneth Marr. As first lieutenants—Paul F. Baer, Willis B. Haviland, Charles M. Jones, Granville A. Pollack, Leland L. Rounds, Joseph C. Stehlin, George E. Turnure, Jr., Frank W. Wells, Charles H. Wilcox, Charles C. Johnson, Charles H. Donal, Jr., and Henry S. Jones. As captain for service as instructor—Dudley L. Hill.

The Airplane Last Year.—In the matter of the airplanes themselves, remarks *Flight* in reviewing aeronautical progress for 1917, it would appear that the chief feature has been the general growth in size, which generally speaking applies to all the various types of machines in use. The little fast single-seater fighter has grown to proportions somewhere between the 1916 two seaters and the previous single-seaters. This is principally due to the fitting of a larger water-cooled engine, which not only takes up more room and calls for a deeper and altogether more roomy fuselage, but which also is very considerably heavier and therefore requires a somewhat greater wing area in order to keep the landing speed within reasonable limits. As a type this machine has not changed very much. One finds the synchronized machine gun and in some cases, although by no means invariably; an additional gun capable of being swiveled. Altogether there seems to be, as regards the single-seater fighter, a tendency to increase the armament from one synchronized gun to two, and to carry in addition one or more guns that may be fired in directions other than straight forward. The two-seater fighter or reconnaissance type has not undergone any radical changes beyond the increase in engine power which appears to be common to all types. It has now become, practically speaking, universal practice, both with the Allies and among our enemies, to place the pilot in the front cockpit and to arm him with two synchronized guns, the gunner being placed in the aft seat and armed with a gun on a turntable enabling him to fire in all the directions left free by various parts of his own machine. Probably of all the types in use the one that has come to be taken up and developed to the greatest extent is the twin-engine machine. It is met with extensively in all the belligerent countries, and it may safely be stated that the large twin-engined machine has come to stay, not only for purposes of war but equally certainly for commercial flying after the war.

Science

The New Field Museum.—It is now expected that the new home of the Field Museum, in Chicago, which has been under construction since the summer of 1915, will be ready for occupancy by August 1st, 1919. The building is of Georgia marble, 756 by 350 feet, and will cost $5,000,000.

Earth Tremors Due to Thunder.—A peculiar effect of thunder was recently reported to the Weather Bureau by Mr. Douglas F. Manning, of Alexandria Bay, N. Y. During the storm, which prevailed in the evening, each rumble of thunder caused windows and doors to rattle, chinaware to jar, and tremors in the earth simulating the shocks of an earthquake. Many persons thought that an earthquake was in progress. The Weather Bureau states that since "musical" notes of very low pitch and great volume are sometimes produced by a series of sequent or pulsating lightning discharges, the shaking described was probably due largely to the resonance response of rooms to thunder notes of this character.

The Smithsonian Exchange Service and the War.—In view of the great extent to which scientific institutions in this country depend upon the international exchange service of the Smithsonian Institution for their supply of foreign literature, it is gratifying to learn that up to the end of the last fiscal year no shipments of such publications addressed to the United States had been lost by the torpedoing of ships or other hostilities. Since the beginning of the war the service had lost only three consignments of publications in this manner; two bound for India, and one for France. On the other hand, the service has been entirely suspended to some countries, and temporarily or intermittently suspended to others.

Trachoma in Armies.—The history of every European war shows that trachoma has gravely menaced the efficiency of the fighting forces, invaliding thousands and blinding large numbers. During the Russo-Japanese War the Japanese troops suffered very severely with this disease, and it is reported that an epidemic of it has occurred in France during the present struggle, having been introduced into that country by soldiers and laborers from Africa. The surgeons in our own army have been urged to exercise the greatest vigilance with respect to this disease, which is an especially serious danger in posts and camps located in some of the southwestern states, where trachoma is known to be endemic.

Effects of Low Temperatures on Plants.—The United States Bureau of Plant Industry has been making a laboratory study of the process known to gardeners as "hardening off" plants, by exposing them to low but not injurious temperatures to increase their hardiness. It is found that as the plant becomes increasingly resistant to cold the cell sap becomes more concentrated. When temperatures are carried low enough to produce injury, a change of reaction in the plant juices takes place, and proteins are probably precipitated. If the change in reaction does not go too far, the cell recovers, but not otherwise. This is, of course, a subject to which much attention has been paid by biochemists, but the chemistry of freezing in plants remains obscure.

Italian Earthquakes.—Statistics recently published by A. Cavasino show that 5,922 earthquakes were recorded in Italy during the years 1891-1910; an average of 296 a year. Signor Cavasino also states that the Messina earthquake of 1908 was followed by no less than 1,227 aftershocks. His statistics throw some light on the question of the relative frequency of earthquakes by day and by night. It has been alleged that the supposed greater frequency of nocturnal quakes is only apparent, being due to the fact that quiet conditions at night make the shocks more readily perceptible. It appears, however, that considering only those shocks which were so intense that they could not have escaped notice at any hour, 865 occurred during the 12 night hours while only 638 occurred during the 12 day hours.

The Frozen Soil of Alaska.—The depth of permanently frozen soil in polar and subpolar regions is a subject of perennial interest, concerning which few data are available. In numerous excavations made in placer mining in Alaska the ground is permanently frozen to great depths, beginning 18 inches or two feet below the surface. In the Klondike, according to the Geological Survey, the alluvium is frozen to a depth of about two hundred feet. At Fairbanks permanent ground frost has been found at many places to a depth of more than two hundred feet, and the deepest shaft there penetrated 318 feet of frozen alluvium. In Seward Peninsula many holes in permanently frozen alluvium are more than seventy-five feet deep, and one is nearly two hundred feet deep. On the other hand, some ground in this region is not frozen, for reasons not understood. According to Dr. A. H. Brooks, when the moss is stripped from the soil the ground thaws, and with open-cut mining or cultivation the upper level of permanent ground frost seems gradually to descend. It is therefore believed that this ground frost is a survival of a climate colder than the present one, and is preserved by the non-conducting mat of moss and other vegetation.

Engineering

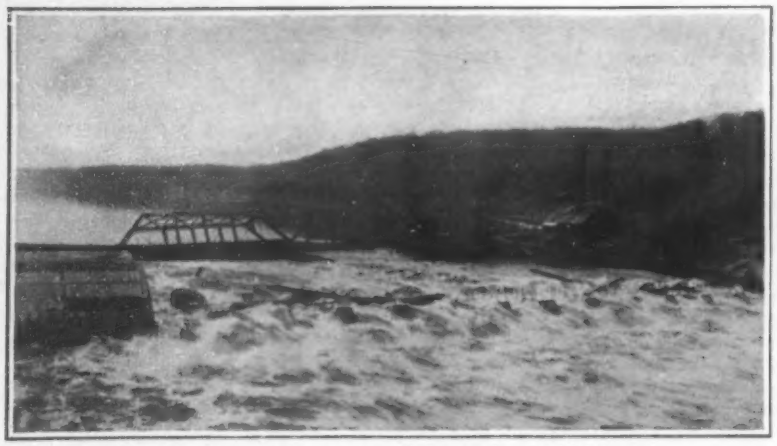
Camouflaging Dynamite Magazine.—On one of the Brooklyn sections of the new rapid transit system, which is now being built, a clever system has been conceived for screening the magazine in which explosives are stored, from the eyes of malefactors. Around the magazine are boxes in which vegetables are grown. In this small garden beets, beans, radishes, cucumbers and a sprinkling of cantaloupes were raised last season. The result of this scheme was to adorn the space occupied by the contractor's plant, and to reduce the cost of living.

Cutting Tanks in Two to Clear Draw-Bridges.—An interesting expedient was recently used to permit of transporting a number of large tanks up the Chicago River. There were two dozen of these tanks, and they had to be taken from South Chicago across the Lakes and through the river to West 36th street, but the diameter of these tanks was too large to permit of passing between the piers of the draw-bridges. Accordingly they were sliced in two and braced with timbers. After they had been transported to the desired locality they were reassembled by adjusting the halves together with jacks so that the rivet holes would match.

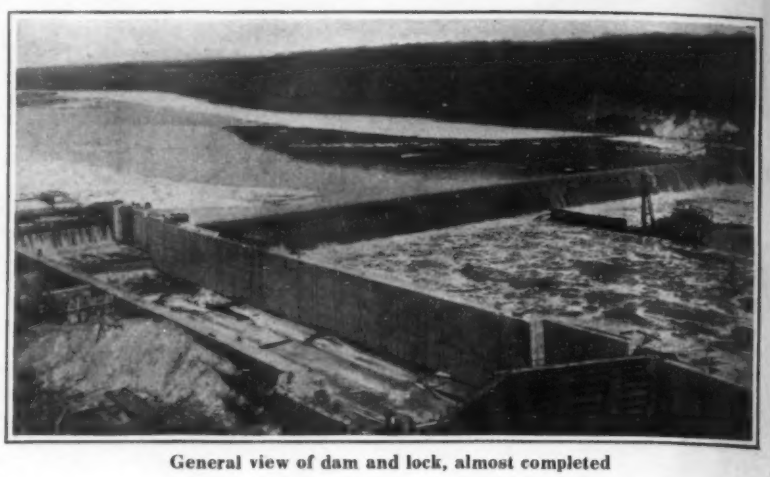
Dusty Roads on the Western Front.—In a recent issue of *Engineering News Record*, there is an interesting article on American Road Building Work in the French War Zone, in which attention is called to the fact that most of the French roads are built of water bound macadam, with a very small mileage of tarred surface back of the British lines. French limestone compacts readily under the road roller and makes a very good road building material, although it requires constant maintenance. One of the principal objections to the water bound macadam road near the front is the dust which rises from it in dry weather under heavy traffic. Owing to the scarcity of oil, it is next to impossible to keep the dust down. In some of the towns near the front there are large signs along the roadside, cautioning drivers of motor trucks to run their cars slowly, as fast driving will raise clouds of dust which are apt to draw the artillery fire of the enemy. The mileage of French roads is estimated as one mile of road for every one and one-half square miles of ground surface. While most of the French roads are of ample width, there are many secondary routes only 18 feet wide.

Thawing Plant for Coal Cars.—The severe weather that we have been passing through has not only resulted in congestion of traffic, but has presented a serious problem in connection with the thawing of frozen coal. Cars have reached the vicinity of New York with the coal in such a solid mass that it has to be practically mined out of the car. This is not a new condition. Every winter troubles of this sort arise, although never to the extent experienced this year. Sometime ago a plant was established at South Amboy, N. J., to thaw out frozen coal. This consisted of a building furnished with steam hose terminating in perforated pipes which could be driven into the frozen coal and through which live steam could be admitted into the coal. The result, however, was unsatisfactory because the steam in passing through the perforations merely thawed out a cylinder around the pipe and then escaped through this thawed-out cylinder. As a result of this experience, a new plant was erected in 1916 in which hot air is used in place of steam. A large building of concrete and steel has been constructed in which the coal cars are introduced on three tracks, each track running in a separate insulated room. By a system of blowers and steam coils, hot air is introduced into the rooms and blown against the sides and bottoms of the coal cars, and the coal is thawed without introducing further moisture into the car.

Organizing Spent Steam.—Every city has hundreds of exhaust pipes discharging steam into the air, says *Power*, a waste from small industrial plants which might be stopped by a slight expenditure for pipe extension which would connect these hundreds and thousands of non-condensing engines to the heat system of adjoining properties, thus heating buildings with steam which is going to waste, permitting the shutting down of thousands of heating boilers, and the diversion of coal to power plants which urgently need it in the present crisis. *Power* favors what is termed the isolated block central station for the cheapest, most economical, and most convenient production of heat, light, and power. This idea has been developed to some extent in the larger cities, but never on the extensive coöperative lines which the present fuel crisis demands. In proof that such a system would pay, there are cited the central steam-heating plants in many cities and suburbs, which generate steam for no other purpose than to supply heat to customers, not as a by-product, but as a commercial proposition, carrying satisfactory profit. Besides the convenience of such a system to steam-using customers, and the more economical burning of fuel at central stations, with non-fluctuating supplies of heating steam day and night during winter, the isolated-block plant would make unnecessary the large investment in small boilers and furnaces for office buildings, stores, residences, schools, churches and the like.



The working span that was carried away by the high water



General view of dam and lock, almost completed

Building a Dam of Concrete Slabs

An Interesting Type of Construction Adopted in the Twin Cities River Improvement

By J. F. Springer

ST. PAUL and Minneapolis lie on the banks of the upper Mississippi with an interval of 14 miles of river between them. Obviously the stream should serve as a means of communication. But the natural depth at the Minneapolis end of the stretch is but two feet or thereabouts when the water is at its lowest. Nevertheless Nature provides so much that little, comparatively speaking, has been required of man in order to convert the stream into a thoroughly practicable year-round six-foot waterway.

At the beginning, a quarter of a century ago, it was proposed to provide for only a five-foot minimum depth and to take no account of power possibilities. Today the project is a completed one, and not only has an additional foot of low-water navigability been provided, but the basic construction for a power development has been attained. As constructed the works consist of a dam 568 feet long with a power house substructure adjoining its eastern end and a commodious lock at its western extremity. Pretty much everything is of concrete, and a large part of the material is reinforced.

The dam is a hollow structure—or better, a string of hollow compartments. A cross-section is almost triangular in outline. On the up-stream side, the dam face slopes up to the crest at an angle of about forty-five degrees; on the other face there is a downward slope of perhaps 60 degrees from the horizontal. In the region of the crest the down-stream face is somewhat convexed; and at its base there is a concave curve connecting with a broad concrete floor which extends forward a distance about equal to the thickness of the dam at its base. This floor is technically known as the apron and its function is to take up the shock of the water plunging down the face of the dam and direct the flow into a horizontal plane. Anyone who has noted the tremendous pit which is formed in the river bottom beneath the most attenuated waterfall will realize the advisability of this measure. When water flows over the crest, we have a graceful reverse curve connecting the horizontal flow of the stream at the upper level with that at the lower one. The apron not only preserves the river bottom from being eaten away by the water, but protects the dam itself from being undermined from in front.

A notable thing about the construction work was the fact that the dam was built partly of concrete poured in place and partly of premolded slabs. The crown or roll of the dam was cast in place; the faces were formed of slabs cast and partially matured before being set in position. Nineteen of these beams or slabs went to an upstream face and eight to a downstream face. Metal loops were embedded in each beam when cast, and these not only facilitated the handling but were so placed that a twisting during suspension was eliminated.

The original plan for improvement of navigation in this region contemplated two locks and two dams, grouped in pairs about three miles apart. After both locks and the lower dam had been built the plan was changed to that of a single dam and lock on the lower site, with double the height. While it was possible to utilize a good part of the work actually put in, much more had to be torn out.

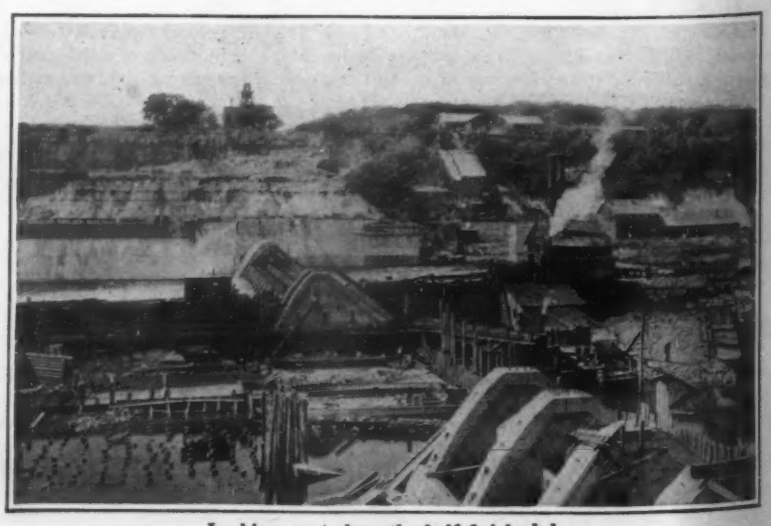
Putting down a foundation of piles for the apron

The removal of old concrete is sometimes a very difficult job, and doubly so here, where it was necessary to take out 3,000 cubic yards or more of old lock floor without damage to the side walls, which formed part of the revised scheme. The blasting holes were drilled to within about six inches of the bottom. Forty per cent dynamite was used, first to break up the central portion, then to fracture the concrete near the side walls. To this method, taken in connection with the use of smaller charges near these walls, is probably due the successful maintenance of these structures. The expense of the operation was materially increased by the necessity of using the oxy-acetylene cutting torch in removing the metal reinforcement.

The use of concrete has spread wonderfully during the present century. There are at present in existence two great works each of which consumed in the neighborhood of five million cubic yards of concrete—the Panama Canal and the Catskill Aqueduct. There is, however, one thing that tends to restrict the still wider use of this notable material. The forms often cost excessively. In the case of this reconstructed lock, one problem that presented itself concerned the vertical forms for the additions to the height of the side walls. The procedure adopted is a very interesting one. Instead of setting up timber or steel forms, it was proposed to construct a comparatively thin wall of premolded concrete blocks. These were to be furnished with tongue and grooves so that they might interlock, and the walls were to form the faces of the upper portion of the lock walls. All the blocks were made four feet high, but some were six and some three feet long. The shorter blocks were made nine inches thick, with groove; the longer ones only six inches, with tongue.

Naturally these blocks had to be set in place vertically. To facilitate the mechanical handling, a number of hook eyes were cast in a vertical (*not horizontal*) face of each individual block. Two horizontal rows of such hooks were provided—one near the bottom and one near the top. The lifting was done by means of hooked rods suspended from a ring, the hooks engaging eyes in the *bottom* row. These rods were held close to the face of the block by means of a removable rod with projections which could be readily slipped into and out of the eyes in the top row. The face of the block containing the eyes was set in the interior of the wall, where the eyes would be out of the way. In addition, by running steel rods through the eyes and then bending these, a means of tying the block to the mass concrete was secured.

A close view of the details of the dam construction, showing damage done by flood



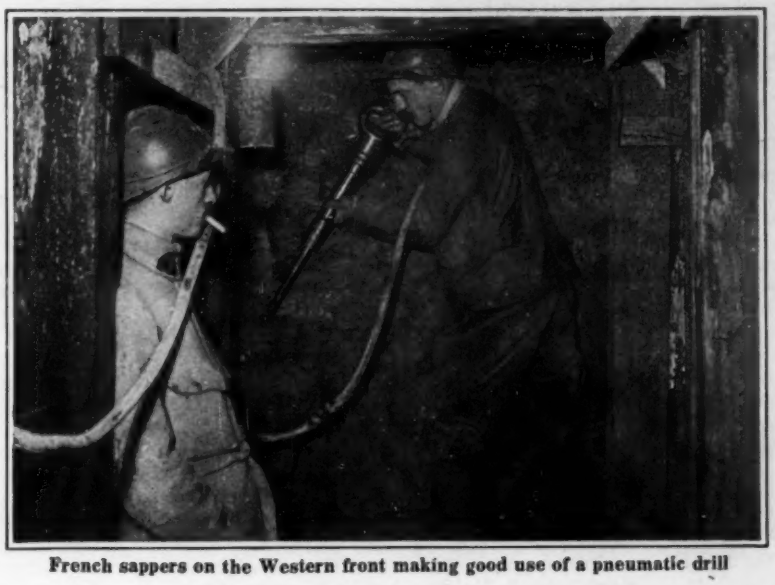
Looking west along the half-finished dam

Blowing Up the Enemy

Large-Scale Mining Operations as a Weapon of Offensive Warfare

ONE feature of the great battle of Messines Ridge will always be remembered above all others, and that is the simultaneous explosion of 19 mines containing something like 500 tons of high explosive, on the eventful day of June 7th last. Certainly not before that date had the war developed mining operations on any comparable scale, and it may be that for many a day this will stand as a record in this field of military activity.

It appears that a year before the battle of Messines Ridge the British engineers began to drive mines beneath the hills held by the German forces, after it became apparent that the usual methods of bombardment and infantry attack would be of no avail, owing to the commanding positions of the enemy. Perhaps the plans at the beginning were of a most modest nature, but as the work progressed the engineers extended their activities until these assumed gigantic proportions in the form of 19 mines containing over 500 tons of high explosive.



French sappers on the Western front making good use of a pneumatic drill

Despite the evident force of the mines when they would be released to send the enemy and all his works high into the skies, the British still relied greatly on the usual heavy artillery preparation. So overwhelming was the fire that not much was left above ground of what had formerly been the enemy's organized works; indeed, as an indication of the preliminary bombardment it is interesting to note that one British division alone fired 46,000 shells from its heavy guns and 180,000 shells from the field artillery. The sound of this mighty cannonade could be readily heard in certain towns in England, 130 miles away.

Everything being ready on the British side by the evening of June 6th, the artillery maintained its drum fire with even intensity. Early in the morning the final inspection of the mines and the firing apparatus was made, and at 3.10 A. M. the electrical buttons were depressed, releasing 19 man-made volcanoes upon the unsuspecting Germans whose concrete emplacements and deep dugouts were as a house of cards against the terrific forces which hurled them into the air, in more or less atomized form. Strange as it may seem, some German troops came through this frightful ordeal, but so dazed were they by the force of the explosions that their subsequent resistance was quite ineffectual against the onrush of British troops which stormed the entire ridge, and advanced some distance beyond.

What happens when a mine is exploded: The work of Canadian sappers in France

On the Italian front mining operations have figured conspicuously in the advance of our southern Ally's troops; in fact, the very nature of the fighting along the Alpine front lends itself admirably to sapping operations. In contradistinction to the mining operations on the Western front, the Italian mining operations are carried on mostly through solid rock, so that the work represents the last word in tunnel engineering.

In 1916 the Italian forces decided upon the mining of a peak known as the Castelletto, which was over 12,000 feet above the level of the sea, in the Dolomite region. The Austrians, it appears, had not only made the most of the splendid natural defences of the peak, but had carved out caves and loopholes in the rocky mass, converting the Castelletto into a veritable Gibraltar. Because of the mass of machine guns and light quick-firing pieces concentrated in the caves of the peak, the Italians soon learned the futility of attempting to take the position by usual means; mining, it appeared quite certain, was the only method which offered any hope of success.

In all, the Italian sappers pierced a tunnel 1,663 feet in length through the rocky mass of the Dolomite mountain, requiring the excavation of over 2,200 cubic yards of rock. Pneumatic drills were employed for the bore holes, and at first the blasting was carried out with military gelatin and later with dynamite. For the work four squads of sappers were employed, each squad, comprising a foreman and 25 to 30 men, worked six hours at a stretch. In describing the later phases of the work Engineer L. Malvezzi, Second Lieutenant in the 7th Regiment Alpini and in charge of the mining, states:

"It was originally intended to divide the explosive charge between two chambers, each having a mining line of resistance of about sixty-six feet with a 16-ton explosive charge of 92 per cent gelatin. However, owing to the countermining work carried on by the enemy—we were only a few yards from one of his positions during the charging of the mine chambers—we were obliged to confine the entire charge to a single chamber.

"The enemy, meanwhile, with a view to avoiding the effects of our mine beneath the peaks of the Castelletto, had transferred most of his shelters to the side of the Tofana and the Selletta. This necessitated a considerable alteration in the location of the mine as originally planned, in order that it should act against the enemy shelters on both the Castelletto and Tofana flanks rather than on evacuated soil.

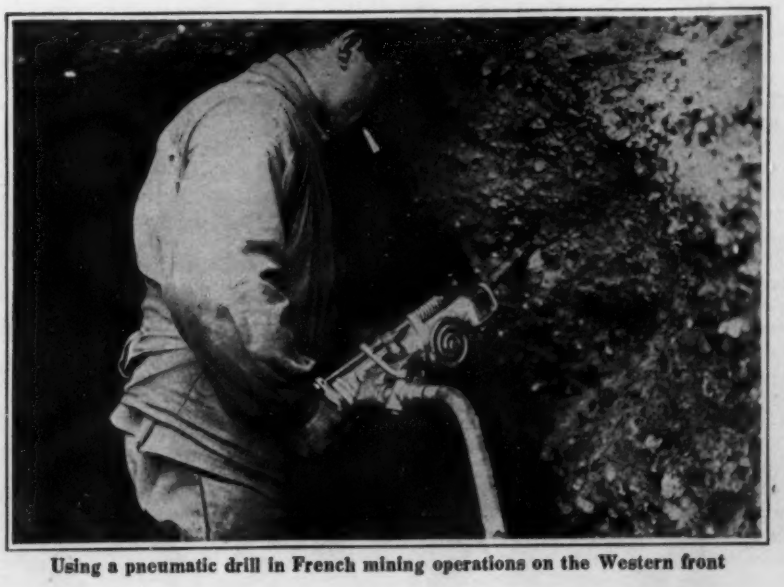
"The charge was computed on a basis of minimum resistance of about sixty-six feet, taking into consideration the nature of the rock (which was fissured) and the existence of numerous splits and caverns. The coefficient of overcharge was, therefore, rather high. In order to obtain the maximum effect under these conditions, only 92 per cent explosive nitro-glycerin was used. The total charge was 35 tons.

"The method of priming adopted was suggested by Lieutenant Colonel Tatoli, of the Engineers' Corps. This consisted of five priming groups, each of three friction tubes. One of the groups ran along the central axis of the chamber, while the other four, parallel with the first, were disposed symmetrically, facing the four corners of the chamber. Each tube (1¼ inch in inside diameter, by about fifteen feet in length) was alternately charged with gelatin and guncotton and pierced by picric acid detonating fuse, ending in a guncotton cartridge with electric percussion cap. In the very center of the charge there were inserted two cases of guncotton, with electric percussion cap and detonating fuse, with a view to securing a second springing of the mine to follow the first.

"We thus had in all 17 electric circuits divided into three groups, each formed by the circuits of five tubes, connected with the five groups of friction tubes. Two of these electric groups were composed of six circuits each, by adding the two circuits of the above-mentioned cases containing the guncotton. Each of these electric groups ended with an exploder, placed at a distance of about fifteen feet from the mine chamber.

"The tamping was effected with cement and with sandbags, with heavy wooden beams between the latter. It was made more effective by dividing into sections at right angles to each other. The theoretical length of the tamping was about eighty feet.

"The charging of the mine chamber began July 3d, 1916, at 5 P. M., and was completed at 3 P. M. of July 9th, this work including tamping, priming, and laying of electric circuits. The final connections between the latter and the exploders, by means of wires suspended in the air, were made on July 10th. The mine was sprung on the 11th of July, at 3.30 P. M., and responded fully to our calculations and fondest expectations."



Using a pneumatic drill in French mining operations on the Western front

Strategic Review of the War, February 12th, 1918

By Our Military Expert

THE last days of January witnessed the beginning of what promise to be movements of great importance in the ultimate results of the Austro-German Italian campaign. Towards the end of the month, the Italians struck a hard blow in the mountain region west of the Brenta and east of the Asiago plateau, where the enemy had endeavored to push down the Frenzela valley toward Valstagna and Bassano. The Italians advanced along the whole stretch of the heights from the Brenta to Asiago where prisoners in some numbers and war material were captured. All the positions taken were held against violent counter assaults from the enemy. From the extent of ground covered in the operations, it was evident that the move was more than a local thrust as the distance over which the advance took place from the Brenta to the Nos valley was at least five or six miles. It was an astonishing midwinter offensive carried out in this mountainous region where in many places the snow lies several feet deep. The Austrians were taken entirely by surprise; for the Italians, in order to reach the Austrian lines, had to scramble through deep snow banks in the assault. The first successes were rapid, followed up by important gains on both sides of the Frenzela valley, three dominating heights, Monte di Val Bella, Col Dechele and Col del Russo on the descent toward the western edge of the valley being taken and held. Sasso Rosso or Red Rock on the eastern side of the valley was also taken and all attempts to recapture were repulsed with great losses to the enemy.

The Italian successes on both sides of this valley wipe out entirely the salient that the invaders had driven into the front between the Brenta River and Asiago; this salient had offered the most practicable route down the Frenzela valley to the plains of Venetia. As it now stands a vital blow has been given to the Austrian hopes of reaching the plains easily and quickly when spring opens. By the French successes on and near Monte Tomba toward the Piave and by the Italian offensive between Asiago and the Brenta, the Entente Allies have removed the greatest menace to the safety of the Italian defensive lines and have greatly improved the chances of Italy's driving back the Austro-Germans entirely when the next attempt by the latter is begun. It can be said that another door has been closed and locked against the invaders by the two recent midwinter offensives, provided the positions already taken can be strengthened and held by artillery and by an ample supply of ammunition. They must be fortified to reap all the advantages that have been won; but the Italians, since the Isonzo retreat, need guns very badly and Italy cannot well manufacture them unless the Entente Allies send coal to supply deficiencies. Unless ample artillery can be obtained, it may be very difficult for the Italians to hold their present advanced lines when weather conditions are more favorable for an attack upon them. The Germans had concentrated troops and had actually started an offensive movement on the lower Piave River; but this failed to materialize, as the Italian commander struck on the northern front at the point where the most decisive results could be obtained, thus neutralizing and counteracting any hostile operations elsewhere. While the spirit shown by the Italians in their advance under such adverse conditions points to a return of the fighting energy that was so marked in the long struggles around Gorizia, the results of the recent battles and the present daily attacks and counter attacks are undoubtedly having their effect on the enemy's morale.

The Austro-German winter campaign had been stopped entirely for it was naturally believed that the difficulties resulting from snow and ice with the consequent interruption of roads and transport of supplies had rendered military movements impracticable. What the Italians have done and are doing now in the mountains will go far to remove the criticisms and the effects of their previous disasters, for they have succeeded in restoring their lines to the commanding positions which they occupied when their opponent made his forward movement in this part of the line just before Christmas. They now have their main defensive line firmly established on the strong positions of Col del Rosso and Monte di Val Bella between the Asiago plateau and the Brenta; the French hold the bastions of Monte Grappa and Monte Tomba between the Brenta and the Piave. The Allies therefore face the Austro-Germans from lines easily defended and strongly intrenched. Before the Austro-Germans can threaten the main routes to the plains of Venetia, they must again take the commanding points that have been recaptured from them in the midwinter actions. Their campaign has received a check that it may require weeks to overcome when another advance is attempted in the spring. The last accounts report heavy artillery fire on the sectors mentioned above; but the Austrians appear to have stopped infantry activity which may indicate that they have little hope just now of once more gaining possession of the important positions taken from them. Their recent counter attacks have been most costly both in men and materiel and further operations at present with both winter and superior positions against them can lead only to additional losses and fruitless efforts.

On the western front lively trench raids and some artillery actions have been reported in official dispatches; but no operations of importance have occurred as both sides are apparently waiting for better weather conditions before making a move. That German troops, despite the armistice on the eastern front, have been moved from Russia to France has been confirmed by the statements of prisoners taken. This is said to have been done in a characteristically German under-hand manner by granting leave to the best troops there and filling their places by very young and by older men and also by invalids not suited to the hardships of trench life. After the expiration of leaves granted, the efficient men have not been returned to the lines, but have been sent to the French front. While everything has pointed to a strong drive in the west by the Germans, there is a possibility that this may have to be postponed or abandoned on account of the internal troubles resulting from the recent strikes throughout the country. There is a clear lessening of concern on the part of the Entente Allies over the German threats of delivering the most powerful blow yet tried against the Allies in France and Belgium because the continued demonstrations in the German cities against a continuance of the war and the demands for an immediate peace are having their effect.

Scene of latest Italian advance

These demonstrations have reached almost the point of revolt and have become at times a serious menace against the German war programme, temporarily at least. It seems hardly probable that, under present economic and political conditions, German military leaders would again run the risks of another Verdun failure or a Somme "strategic retreat" but will rather content themselves with defensive measures to hold on to their present lines. Peace with victory has been promised so often, however, that the leaders may regard present conditions as making it absolutely necessary to undertake within the shortest possible time a strong offensive on the western front; because, if the war is prolonged until next autumn, the moral and material forces of the Central Allies would not be able to resist the strain when our own country has entered the field in full strength. It must be evident by this time to the German people that they are hopelessly outnumbered in size of armed forces and outclassed in military materiel and that it is only a question of time when the Entente Allies can enforce a durable peace. There can be but little doubt Germany's Allies are now beginning to realize that any further continuance of this war will be still more disastrous for them than it has been and that they are now being used only to strengthen Germany's hands in her schemes for world conquest.

It looks at present as if Austria were beginning to realize these facts and as if she were beginning to see that, if peace is not declared at an early date, she will be hopelessly ruined financially and economically. Her interests are entirely different from those of Germany; she sees that German control, which has grown now both in her army and in her political life, has in view only German self-interest, and that it must inevitably end in a collapse in her present form of government and in a revolution. Her people and her army are showing how tired they are of German influence and authority, both of which are evident on all sides; they are demanding that Austrian interests shall not be sacrificed to German Mittel-Europa designs, annexations, and conquests. It is possible too that at the first military defeat, the whole German and Austrian machinery may collapse and in that case there would be an immediate demand in both countries on the part of the people for a strict accountability from those who are responsible for the present great world war. To hasten so desirable an end, it is now hinted that, without waiting to see the effect of German internal conditions upon the German war machinery, the Entente Allies are making every preparation for strong drives against the Central Allies on the western front. It would certainly appear that military and political considerations would render inevitable such strong offensive movements; for one thing, the Allies feel themselves much stronger than the Germans in both men and materiel and at no time in the near future will they be better prepared to drive at the German machine.

Under such conditions it is stated that there will be a general Allied offensive all along the 450 miles of front from the sea to the Swiss border with the center of the attack on the Flanders front held by the British; heretofore such advances as the latter have been able to make have been checked because the Germans could strip other sectors of men and guns for the defense of threatened breaks in their lines. But now, with our own troops to strengthen the Lorraine front, French veterans can be released to back up the French lines between Lorraine and the British front in Flanders. The Flanders front will possibly see the heaviest fighting, as the British are best supplied with munitions; in addition, it is essential that the Germans be driven back and away from the submarine and naval bases on the Belgian coast. Should, however, in the general plan of advance, any weak spots in the German lines be developed elsewhere, they would be attacked with all the forces that the Allies could muster.

Reports are being constantly spread by the Germans that they now have and will have a tremendous numerical superiority on this front over the Allies; it is known that they are securing troops from the eastern front and are taking all available men from other points for the coming battles in the west; but, despite all their efforts, it is still believed the Entente Allies have superior numbers in men and guns and that the morale of their troops has never been better. Military operations on the western front appear to be growing each day as weather conditions continue favorable; infantry and artillery actions on both the British and French fronts are becoming more extensive; active operations are mentioned all the way from the Arras section to the Vosges mountains. The grand advance by one side or the other, so long heralded, can be looked for now at almost any time. Among other sections that may witness violent struggles, there may be mentioned Alsace and Lorraine, where the presence of American troops has been published. The parts of both provinces through or near which the allied lines extend are composed of hilly and broken ground all along the borders. Especially in the mountains, the country is of such a nature that the movement of large bodies of troops is almost impossible. The French pushed across the frontiers when the war began in 1914 into German territory; but since that time there have been no engagements here of importance as it was so much easier to concentrate and maneuver troops in the more open country to the north and west. There is a strip between Pont-a-Mousson and Badonviller and St. Die, about sixty miles in extent, that offers great opportunities against German lines of communications although so far but little has been attempted here. This has been due, no doubt, to the fact of the German advances through Luxemburg and Belgium and to the necessity therefore for shifting the war centers to Flanders and northern France to push back the German hordes. But the section named offers great advantages for a starting point for an attack, not only upon hostile communications but also for attacks on the great German fortresses of Metz, Strassburg, and other valuable strategic points. A glance at the maps will show that no part of the Allied lines is so near to German territory and to the Rhine and that an advance in force here would be a strategic stroke at the spinal column of the German defense.

Correspondence

[The editors are not responsible for statements made in the correspondence column. Anonymous communications cannot be considered, but the names of correspondents will be withheld when so desired.]

Why Cotton Plant Is a Food Plant

To the Editor of the SCIENTIFIC AMERICAN:

In condensing my article, "Cotton as a Food Plant," which appeared in your issue of January 12th, you have omitted information showing the relation between cotton as ginned and baled and the other cotton products. Let me state these:

Raising a 500-pound bale of cotton means, in round figures, producing seed from which are obtainable by common methods of milling the following: 150 pounds of fat, 400 to 750 pounds of cotton meal according to method of manufacture, 350 pounds to no cotton seed hulls according to method of manufacture and 50 to 100 pounds of short lint according to method of manufacture. In other words the food and feed products of the plant largely exceed in total quantity the cotton. The average production of cotton seed per acre is 14 bushels, the same average number of bushels per acre as is grown of wheat. The fat, removable, edible fat, which accompanies a 15-million-bale cotton crop, *as soon as the cotton is ginned and the seed milled*, is the same as the fat which can be recovered from 15 million enormous hogs requiring months of feeding and fattening on high priced grain.

An error was the inversion of the round values given seed cotton (unginned cotton), which should have been $250 a ton, and cotton seed, which should have been $75 a ton. Correction of the statement, "The boll weevil, the hook worm, and the cattle tick still occupy respectively their first, second and third lines of defense" will recognize the magnificent work done by the Department of Agriculture in driving the cattle tick from its first and second line to its last ditch. Lest some sensitive soul may be offended by reference to the hook worm, driven out of its first but still in its second lines, it should be explained that inertia of mind quite as much as anemia of body was intended. There is too much of both everywhere, both in and out of the cotton states, for war time.

The war time feed for cotton mules, intended to save corn, which the animal husbandmen have approved and which still lacks promulgation, is a mixture of 35 pounds of corn and cob meal "ear-corn grist" well ground and well mixed at the nearest possible place to the farm, if not on it, with 21 pounds of approximately 25 per cent protein meal either from cotton seed, velvet beans or peanuts, totaling 56 pounds per bushel of better and cheaper mule feed than a bushel of shelled corn, and making a clear saving of half a bushel of corn possible.

I trust that the publication of these corrections and additional facts will add value and interest to the original article.

LEHMAN JOHNSON.

Memphis, Tenn.

The Frosted Windshield

To the Editor of the SCIENTIFIC AMERICAN:

I note in a recent issue an account of a rubber protection for automobile windshields, which it is claimed will protect against frost, leaving the vision clear. Down here we have a better trick than that.

You go out and find your windshield frosted; you melt off the frost and clean off the moisture with a rag, and the frost will immediately reform and obscure your vision. But if, instead of cleaning the frost off that way, you simply take your pocket knife or any other edged tool and scrape off the frost, it positively will not reform. When told about this I did not believe it, and I don't expect anybody else to believe it, for I know no reason, scientific or otherwise, why it should be true; yet it is. If you will try it you will convince yourself that this is a fact; and you will have no more trouble with frosted windshields. I would ask whether you can account for this phenomenon, and thank you in advance.

P. W. ROBERTS.

Chicao, Texas.

*[Glass is highly hygroscopic, and ordinarily is coated with a film of water. Every housewife admits this when she dries her tumblers while they are piping hot. When the windshield is cleared by melting the frost off by any method, the glass is left covered with a thin film of moisture, which in the outdoor cold cannot be wiped off completely and which soon freezes again, as our correspondent says. But if the ice is scraped off with a knife, little or no ice is left on the glass, and no moisture. The glass is dry and cold, and at the same temperature as the surrounding air. Therefore there is little tendency for ice to form on it again, unless the car is run into a stretch of damper atmosphere. The knife really has nothing to do with the matter, except that it is a convenient means of getting the ice off without creating a film of water. If a cloth hard enough to remove the ice could be used, the result would be the same—unless sufficient pressure were applied to melt the ice partly. Another point of importance in this interesting matter is that water vapor can not condense into drops unless there is a nucleus for the moisture to attach itself to, and an invisible film of water on the glass will afford the best possible point of attachment for more water, while absolutely dry glass, especially when at the temperature of the surrounding air, gives practically no opportunity for this.—*THE EDITOR.]

Multiplying the Power of Niagara

To the Editor of the SCIENTIFIC AMERICAN:

I notice your account of the scheme for increasing the power of Niagara, and would make the following suggestion. By taking the present water from the outlets of both the American and Canadian plants through tunnels to Lewiston, these waters could be used at least twice before reaching that point. Such tunnelling would not be unduly expensive with our present systems for that kind of work. The subject has been quite a hobby with me for some time, and I can see no conceivable objection to the suggestion which I advance.

D. FISHER.

Oil City, Pa.

Filming the Sea With Oil to Beat the U-Boat

To the Editor of the SCIENTIFIC AMERICAN:

I am sending you a scheme relating to the submarine warfare. My plan is to keep the sea covered with a film of oil, in the English Channel, and at the northern exit of the North Sea for a width of 300 miles. If this is too big an enterprise then do the best possible along this line. However, I don't believe such extravagant quantities of oil would be required as might be supposed. The oil used would be cheap and heavy, ranging from 15°-25° gravity, and taken from the lubricating and fuel stocks. I would use submerged reservoirs for the actual oiling operation, and not ships. Suppose a sunken oil-tank containing 900 barrels, fed 10 barrels daily through small apertures on top. For 90 days this supply would go on, not requiring any work or attention whatever. Ten barrels a day will "film" quite an area, and working in conjunction with hundreds of other tanks, properly located, vast surfaces could be kept constantly oiled, and without effort. And the Germans couldn't stop it.

Some of the advantages of covering sea with oil would be as follows:

1. The submarine operates to greatest advantage when sea is rough, choppy, with white caps, and in fog. Oil allays first three.

2. Fog is the submarine's best friend, as it is the worst enemy of all surface vessels in peace or war. A film of oil over wide areas may tend to prevent raising of fogs, as it acts as an insulator between sea and atmosphere.

3. When submarine is running submerged, but near the surface, its displacement wave in smooth water is visible.

4. When running with only periscope showing, the foamy wake is easily seen in quiet water.

5. The white, milky wake left by churning propellers of all vessels, is more readily found by ships or aeroplanes, when surface is free of bubbles.

6. If submarine succeeds in firing torpedo, its track is much more easily seen and avoided.

7. The surface being "slick" floating mines or torpedoes can be easily seen, destroyed, or recovered.

8. Since sea is calm many small boats, unseaworthy in heavy weather are now useful and can join fleet, thus adding to its strength.

9. The speed of all patroling boats and their general efficiency will be much improved. They will require less fuel for the same work.

10. The living conditions and comfort of the crews will be also greatly improved.

11. Because of calm sea it may be possible to anchor out supply or "mother" ships in strategic positions.

12. Nets, heavy barriers, bomb-curtains, detecting systems, etc., may be successfully anchored and maintained, whereas rough water would destroy or tear them loose.

13. Ships can carry hydro-airplanes, and they can successfully start and alight at any time, and far from land. The carrying ship can pick them up without so much trouble or danger.

14. Since the surface is "glassy" the light condition will be good for looking into the depths from airplanes.

15. After several weeks of calm the oily water will settle, impurities will sink, and the surface strata become clearer. This will help the aircraft observation, and the milky wake will be increasingly clear.

16. Airplanes will be better enabled to locate mine fields planted by the enemy near coasts and harbors.

17. If German battle-fleet comes out its accompanying and protecting submarines can be more easily avoided or destroyed.

18. The English Channel is notoriously rough. If calmed artificially the transport and supply service between England and France will be easier, smoother, quicker and safer.

19. Patrol boats with searchlights at night may be more easily enabled to find submarines on the surface, recharging batteries and air flasks, and driving them under.

No doubt the great assistance a "slick" surface would be to aircraft would be the most important feature of all, for aircraft is the U-boat's natural enemy. It is a pure case of—fish and fish-hawk. Give the fish-hawk all possible aid in every way, and the fish will disappear. In the absence of a satisfactory sound-detector which would enable a patrol boat to follow a submarine by sound alone, why not try "sight?" Not by seeing the submerged pirate itself, but tracking it from airplanes by the white, milky wake of its propellers, which rises to the surface. Normally the surface conceals this telltale trace with foam, bubbles, whitecaps and waves. But with a surface like a mill-pond, no such trail of bubbles and froth would remain unseen. Once discovered in quiet waters, and depth-bombs would do the rest.

There seems to be a sufficiency of submarine-fighting equipment, destroyers, patrols, trawlers, airplanes, "blimps," depth-bombs, etc. If we can only add to the efficiency of all of these we will have accomplished something worth while.

DAVID F. ZOOK.

Pasadena, Cal.

Centrifugal Oil Clarifiers

To the Editor of the SCIENTIFIC AMERICAN:

In one of your recent articles, you describe centrifugal machines that have been put on the market in Sweden for the purpose of separating dirt from oils, etc., and indicate that these machines are somewhat similar to the ordinary centrifugal cream separator.

Allow me to call your attention to the fact that centrifugal oil clarifiers have been used in this country for quite a long time. They are, as you say, quite similar to centrifugal cream separators, and are made by the same manufacturers. I have seen these machines used for clarifying gasoline, also oils and varnishes.

You can find these machines in use at the large automobile factories in Detroit, where I have seen them myself.

HARVEY FELDMEIER.

Little Falls, N. Y.

A New Route from Boston to the West

THROUGH train service between St. Louis, Indianapolis, Cincinnati, Columbus, Boston and other New England points, has been inaugurated jointly by the Pennsylvania Railroad System and the New York, New Haven and Hartford Railroad. The Hell Gate Bridge route through New York city, and the Hudson and East River tunnels will be utilized, and the Middle West, for the first time in history, will be directly connected with New England by an all-rail route through the Metropolis of the country.

Toothless Saws Again

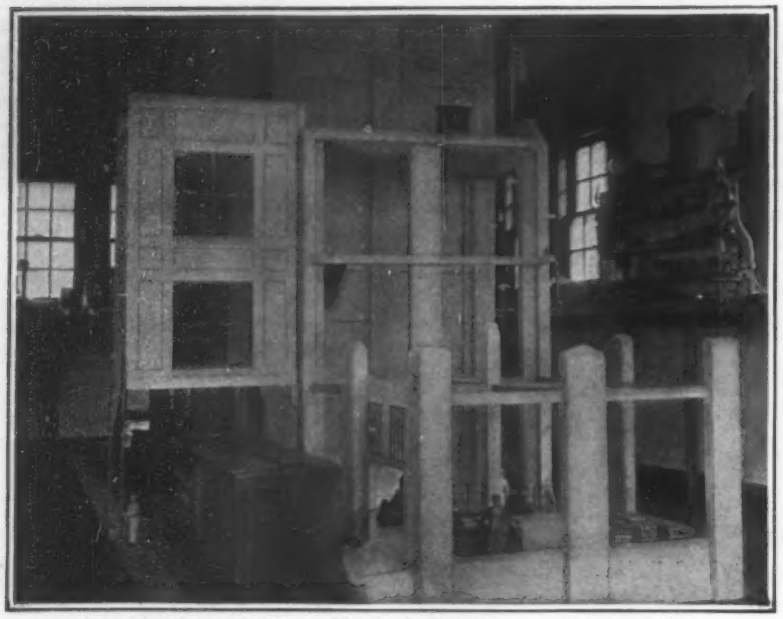
IN our issue of January 12th we carried a little note upon the use, in Germany, of toothless saws for cutting metal. This item has convinced us—if that were at all necessary—that it is a difficult matter to be omniscient. When the note in question came to our attention it was entirely new to us, and, we assumed, to the mechanical world in general; so we published it without hesitation.

It turns out now that the American mechanics had stolen a march upon us. A number of readers, in various parts of the country, inform us that they have been doing this thing for periods as long, in one instance, as ten years. We can only compliment these workers upon the independent ingenuity they have shown, chide them mildly for having kept this good thing out of general circulation, and express the hope that our own *faux pas* will at least result in wider dissemination of the idea.

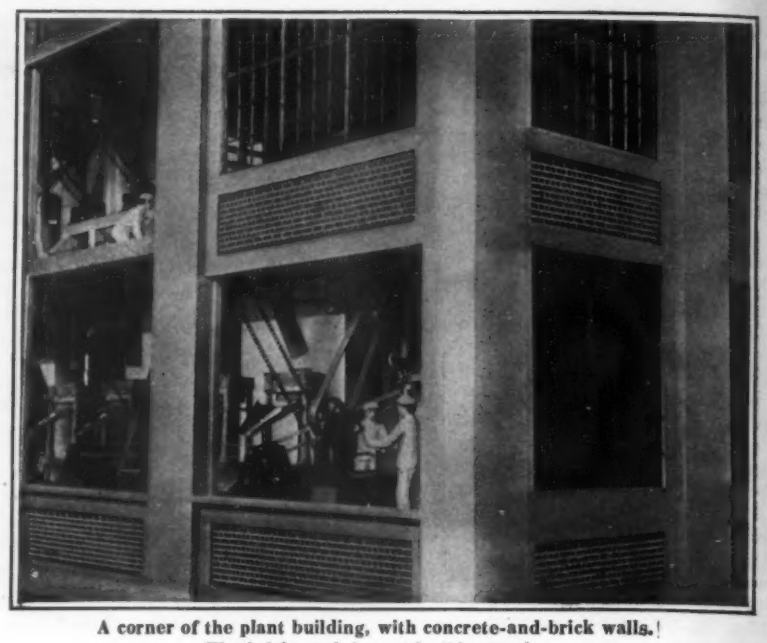
How Long Is a Locomotive?

IN our issue of January 12th we gave a graphic estimate of the United States railroad system into which a certain discrepancy crept. Our railroad expert, in arriving at an average length for all American locomotives, made a sufficient allowance for clearance between engines, since he realized that in the picture which was planned it was the intention to represent the locomotives merely standing in a long string on the track, rather than all coupled together in the hauling of a monster hypothetical train. With such allowance his estimate of 125 feet per locomotive was not excessive; without that allowance it was decidedly so, since our very longest locomotives measure but 121 feet 7 inches from tip to tip.

Unfortunately our artist and the staff writer who prepared the article to go with the picture did not realize that an allowance for clearance had been made; so the story and picture, as prepared, showed and spoke of the engines as though they were actually in contact with one another. Disposed thus, of course, they would average not greatly in excess of 75 feet. We take this opportunity of correcting any erroneous impression which may have been created by the lack of accord between our picture and our figures.



One side of the miniature white-lead plant in course of construction, showing architectural details



A corner of the plant building, with concrete-and-brick walls. The brick-work is cast in thin panels.

The World in Miniature

Why Models Are Built and How They Are Built

MODELS have a very definite place in this world of ours. Time was when a model was considered only as an interesting feature of the museum or the exposition; but today a model is looked upon as a prerequisite for the undertaking of many an important piece of work. In such case it serves to translate the mysterious, confusing, meaningless blueprints into terms understandable to everyone: the technical details of a batch of drawings take the form of a miniature of the projected work, as it were. And the enterprise, in diminutive form, can be examined and criticised and altered until the desired result is attained, with trifling expense compared to that of altering the prototype.

In the planning of country estates the work of the model-maker is of paramount importance. The architects and landscape gardeners, following the wishes of their client, prepare a complete set of plans in the form of blueprints and washdrawings. Blueprints mean next to nothing to the average man; but the washdrawings serve to convey some idea of what he is ordering. At this point the model-maker is often called upon to reproduce the plans in miniature form; and after spending weeks and even months with wood, cardboard, wax, plaster, glue, sand and variegated paints, he provides the architects and landscape gardeners with an attractive model. It goes without saying that the model, showing as it does every detail of the projected estate, immediately conveys the desired impression to the client. It is as if he were looking at his proposed estate through the wrong end of a telescope, with every detail clearly showing in microscopic form.

The client presently knows what is being planned for him. Perhaps he would prefer to change the arrangement of the hedge; or the road is not quite to his liking; or the large shade trees are too near the living-room windows; or the veranda has not been extended far enough on the left side of the dwelling; or the tennis court and the garage should be transposed. All these things can be done in the model at a trifling expense. Where dollars are spent in altering the miniature, hundreds and thousands of dollars would be spent in altering the prototype. And above all the model, costing but a few hundred dollars, avoids untold disappointment later, as can well be imagined.

In the matter of large buildings the model has a very definite application. Such buildings as the Woolworth skyscraper have been reproduced in miniature from the blueprints and washdrawings of the architects, long before the structure raised itself above the crowded sidewalk of Broadway. Indeed, model skyscrapers have enabled many a prospective owner to visualize what he was ordering; in some instances these models have enabled the renting agents to interest prospective tenants even before the foundations were laid.

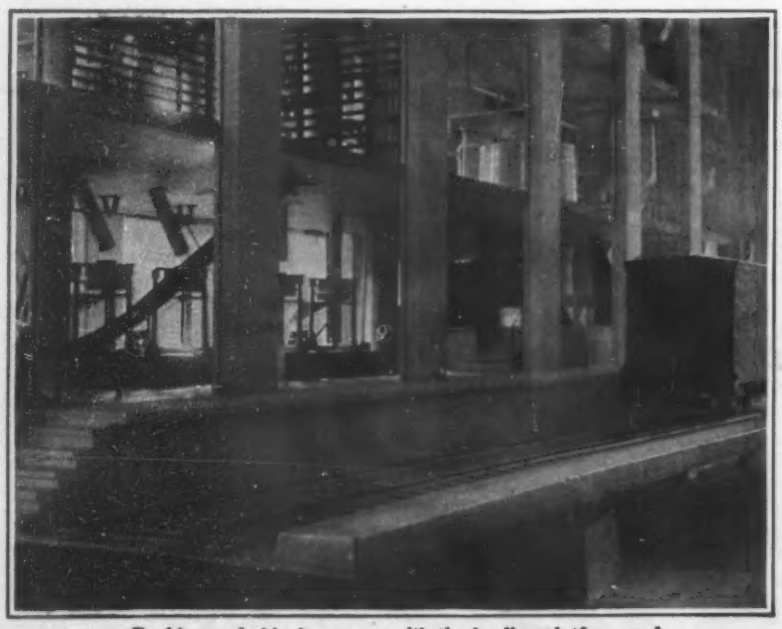
Undoubtedly, the building field is most productive for the model-maker; and architects are coming more and more to realize the value of the model. The story is told of a New York manufacturer of hats who was planning for a new building in the better part of the city, where in keeping with its surroundings the structure had to be esthetic as well as practical. The white-stone front was to be trimmed with flower boxes and pots, with plants and with shrubs, and above all a stone balcony was to grace the façade. That balcony was at once the pride and the worry of the manufacturer: he could not make up his mind where to place it!

It was an inexpensive model that solved the problem. With consummate skill a model-maker constructed the façade of the proposed building, with a detachable balcony that could be placed at the second, third or fourth stories by means of pins and holes. When the model came to his desk, the manufacturer merely had to shift the balcony from one floor to another until he secured the desired effect. In a few minutes' time he made up his mind on this problem which had been troubling him so long.

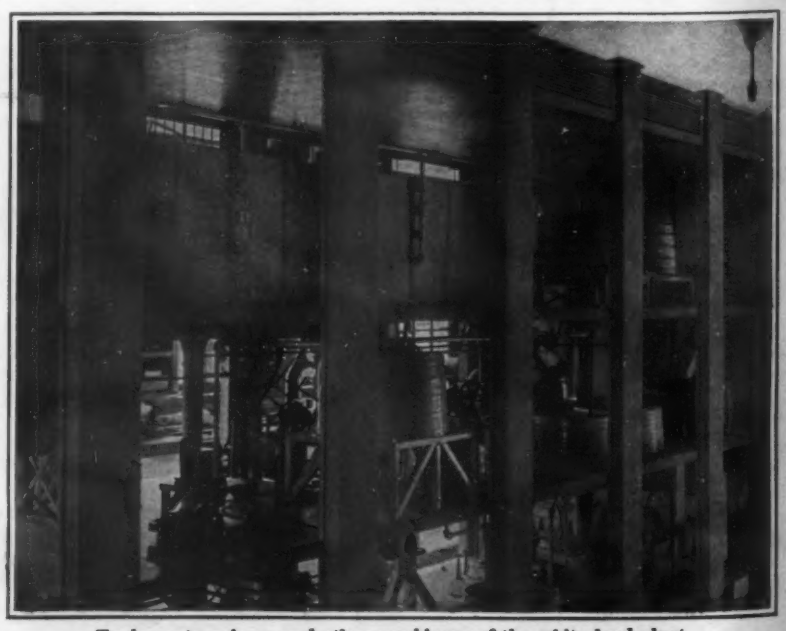
There is hardly a better way of interesting persons in property and homes than a faithful model. Progressive real estate concerns long ago discovered the value of models; and in numerous land offices today are to be found elaborate miniatures showing every house, tree, road, electric-light pole, and topographical feature of certain developments. Dwellings and even large estates are often presented to interested persons by diminutive replicas. And why not? If a photograph tells a story better than words, then surely the model tells its story better than photographs and words; for it lays before the eyes of the interested party every detail at a glance—in natural colors and in three dimensions!

For educational purposes the model is ideal. It is evident that this fact is well appreciated, since all museums are provided with numerous models which may be studied to almost as much advantage as the prototypes themselves. The information is generally collected in the model, in concentrated, digested form, and arranged so as to be readily assimilated by the audience. Thus we have working models of various kinds of machinery, models of ships in some cases partly or wholly cut away so as to reveal their vitals, miniature fortresses with their cannon and munition stores, industrial plants which reveal a given manufacturing process, and miniature villages of foreign peoples, depicting how they live, work, and play. All these things belong in the miniature world.

Model-making splits into two broad classes when considered from a mechanical viewpoint: First, the animated or workable class of models; second, the rigid or non-workable class. The former might be represented by a perfect working model of a steam locomotive or a dreadnought, the latter by a model factory. Each serves a definite purpose, however, although one is more



Packing and shipping room, with the loading platform and railroad siding in the foreground



Tanks, vats, mixers and other machinery of the white-lead plant, with building left open to show interior

a machinist's task while the other calls for artistic handiwork in clay and wax, and, above all, great skill in making small castings. In either case the model-maker must needs be a resourceful person, for at every turn he must face certain difficulties which can only be met by a display of real ingenuity.

Out in Garden City, L. I., is the workshop of Royal Rook, a leading model-maker who specializes largely in buildings, landscapes, and industrial plants, or the non-workable class of models. Mr. Rook's work is so typical of that of the model-making fraternity that a description of some of his work serves at once as a concrete example and general review.

To transfer the workings of a white lead works from plans and photographs to a convincing miniature, was a recent task of Mr. Rook. The object was to produce a model which, at a glance, would convey to the layman a general idea of how white lead is made. Even the statement that years were spent in building this model does not begin to convey an accurate idea of the labor, material, ingenuity, and care entering into the work; and it is only after the intricacies of the task are fully revealed that a full appreciation of models becomes at all possible.

Preliminary to starting work on the model, a draughtsman was put to work in one of the white lead works with instructions to make, on the scale of one inch to the foot, a working drawing of every machine, tub, hopper, mixer, drier, crusher, pump, motor and so on. Obviously, these drawings gave the model-maker something to work with, and from them were made the numerous patterns required for casting the desired parts, as well as the various pieces which could not be cast. Thus the initial step comprised the casting and making of small gears, pulleys, wheels, shaft hangers and other elements.

One by one the miniature machines were then assembled and laid aside; for by now it became necessary to lay out a plan of a building which, cleverly broken away at various points, would carry out the idea of a factory building while still revealing the desired sections of the interior. To work out this problem all the models that were to go on the top floor were placed on the top floor in a dummy building, all the third-floor models on the floor beneath, and so on down to the ground floor of the dummy structure. In this manner the arrangement of the components could be studied by Mr. Rook for the purpose of laying out the factory.

He then made a set of plans for a concrete mill building which, in the main, is a copy of one of the Pittsburg plants. Work im-

(Concluded on page 178)

Where lead pigs are handled. Note the manikins at work and details such as the clock and gong

"All Face" Treatment

THE latest system of treatment for tubercular conditions is a harking back to nature's plan, in which the patient becomes a sort of barbarian. The treatment was first introduced in an extensive way and perfected in this country at a municipal institution for residents of Buffalo, N. Y.

Children are treated for tubercular diseases and each child is naked except for a cap to protect the head, a loin cloth and slippers, with stockings in winter. On bright days in winter, they play unclothed an hour at a time in the snow with the temperature as low as 20 degrees Fahrenheit. The exposed children develop marked resistance to cold or its consequences.

The Indians when the white pioneers expressed wonder at their ability to withstand, unclothed, the severe cold of winter, used to point out that even the whites left their faces exposed, and that the Indian was simply "all face." In a way the children shown in our picture have become "all face." The management states "we have learned by two winters trial that, while adults and children, pursuing the open air treatment clothed for tuberculosis of the lungs, develop colds, the naked children do not. No child under sun treatment has suffered from any illness except two from chickenpox. None has had a cold or influenza.

Harvesting Ice with an Automobile

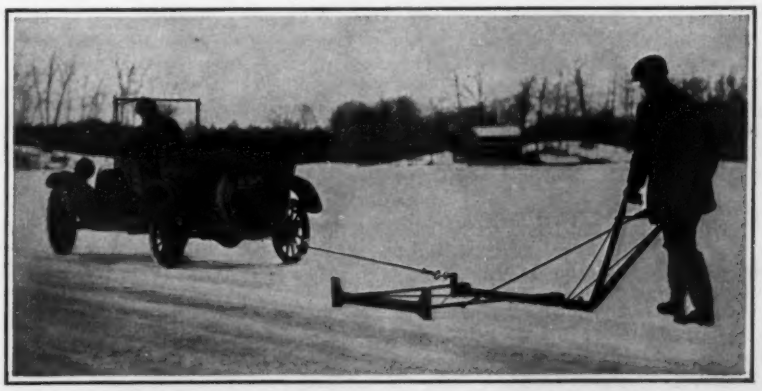
NUMEROUS as are the time and labor saving purposes for which the motor car is regularly used, there is continually cropping up a new one. The latest is the employment of a car to assist in the harvesting of ice. Last spring when the plowing season was on and labor was extremely scarce, an enterprising farmer in Belmont, Mass., hit upon the scheme of hitching a car to a plow and in this way materially accelerated his preparations for planting. To a Wellesley, Mass., iceman, however, belongs the credit for adapting the motor car to his line of business.

This season the ice froze quickly on this owner's pond, and was of excellent quality. He desired to get the crop housed as quickly as possible, but men and horses were scarce and it looked like a long job. Then the suggestion of employing a motor car came to him and it worked out so well that he is enthusiastic, the car proving an entirely satisfactory substitute for horses, of which he normally used 25, with a crew of 85 men. The car was tried first with the ice marker and then with the grooving plow, and it was discovered that in this way a much larger field could be covered than with horses. In grooving the car did the work of four horses and it is believed that it could have been speeded up so as to do the work of six. Then the car was turned to hauling the ice, after it had been barred off, from the far side of the pond to the channel at the house. It was able to tow huge cakes 100 feet while men were poling similar cakes no more than five feet.

Some preparation of the car for this work was, of course, necessary but the changes took only a few minutes and the cost was slight. The rear tires were removed and in their place was put a tire band in which were inserted many steel spikes about an inch long. On the front wheels were put ordinary non-skid chains. The rear wheel device gave excellent traction on the ice, much more certain even than that of horses with very sharp shoes. The ice marker and the groover were attached to the rear springs of the car by a rope. The ice was cut about three times as fast as by horses.

The development of motor ice-cutting machinery is a broad field which may include machines to be ridden by the operator. In this case probably the work could be speeded up materially. It may also be possible to use gang plows. Another possibility is community ice harvesting whereby several people in a neighborhood with one motor car and a set of ice tools could cut their own ice supply and haul it to an ice house placed conveniently to their homes.

"Back to nature" treatment that cures tubercular children



Yet another way to make the "pleasure car" earn its living—cutting ice

A British gas-bag bus that travels twelve miles on a single charge

The Gas-Bag Bus—It Will Not Down

IN spite of the fact that the idea is an absurd one and so recognized by all authorities, the gas-bag motor bus continues to hold its own in England. The reason for this, of course, lies wholly in war-time exigencies; the price of "petrol" and the rigid control exercised has left a field which coal gas is able to fill under the conditions mentioned.

As a wartime substitute, in fact, the gas-bag is reasonably satisfactory. It is at least clean; and despite the unwonted appearance, it is not notably inefficient or liable to failure. To be sure, it cuts in half the seating capacity of the vehicle to which it is attached; and this consideration might well prevent its adoption on busier routes. But beyond all question it does work; and at ruling prices for coal gas it measures up to 16-cent gasoline in economy of operation—or, if we allow for the reduced seating arrangements, at the very worst to 30-cent gasoline. Presumably there are times when the bus companies have difficulty in getting gasoline at any price; but even if this is not the case, the above figures are sufficiently favorable to ensure the continued use of the gas bus.

Seven and eight-ton buses travel from twelve to fifteen miles on a single filling of 400-500 cubic feet. No complaint can be made on the score of the three minutes required for filling; we have been on the New York buses when they stopped longer than that to take aboard a fresh cargo of gasoline.

In some quarters gas-bags have been put forward for the private motor car. These are draped more or less gracefully over the top and back, and do not really look half as bad as they sound. A subscriber in Paris sends us a very interesting photograph of such an installation, but unfortunately we have mislaid his picture—we fear permanently—and so are unable to present it here.

World Markets for American Manufactures

Conducted by WILLIAM W. SNIFFIN

A department devoted to the extension of American trade in foreign lands

Adventures in Foreign Trade

By Crittenden Marriott

BEFORE the war American manufacturers, particularly "small" manufacturers, as a whole took little interest in foreign trade. They thought that they did not need it, except perhaps for the semi-occasional dumping of goods which they could not sell at home; and they believed that any systematic attempt to enter it would cost more than they could afford. In short, they felt that the cost was certain and the returns doubtful. It might, they thought, be all right for big manufacturers, who could stand a loss, but not for small men, who would better keep out.

This idea of the real conditions was an error and a serious one. Many a firm which went down to ruin in the bad years that invariably recur from time to time would probably have survived if, in the good years, it had invested some of its profits in developing an export end to its business merely as a matter of insurance. All too often those who had been too busy to think about foreign trade when domestic trade was good and had turned to it only when the home market failed found themselves in the position of a man who had waited till his house was afire before applying for insurance.

That an established foreign end is an exceedingly valuable form of hard-times insurance has been abundantly demonstrated. Moreover, considered merely as such, it is cheap, and if persisted in it will usually turn out to be profitable—an asset and not a liability. Very seldom indeed does calamity overtake business in all quarters of the world at the same time. When business is bad at home it is very likely to be prosperous abroad and vice versa. Manufacturers who have an established foreign trade have found it of tremendous aid in tiding over domestic crises. At such times a very small foreign end, if firmly founded, can be expanded with marvelous rapidity if necessity compels. But, generally, it must be well established beforehand. The initial cost of starting a business abroad in a hurry is sure to be great and likely to be unsatisfactory, and a period of stress is no time to embark on it.

The Right and the Wrong Ways

The experience of many American manufacturers who had ventured into foreign trade in the years preceding the war perhaps justified the hesitation of others to embark on what was largely an uncharted sea. It was only too easy to find men who had taken "fliers" into the export field and who were dissatisfied with the result; and those who had failed did all the talking, while the ones who had succeeded kept quiet and sold goods. Moreover, few "fliers" succeed in domestic business and almost none in export business, which above all else demands persistency—not necessarily a heavy initial outlay, but a persistent small outlay. In normal times few firms can hope to earn a profit on their foreign business in less than two years. In short, the development of foreign trade is nothing like so costly as it has been supposed to be, but on the other hand it is far slower in growth than most people think. It cannot be worked up in time to meet an emergency.

Since the war began ideas have been changing and the belief that the little fellow cannot afford to embark on foreign trade has been vanishing. Today a very large proportion of American manufacturers are earnestly seeking to find a way to the pie counter. Their earnestness manifests itself in large and enthusiastic conventions for interchange of information. The Foreign Trade Council which holds its fourth convention in Cincinnati in April is a case in point; in three years its membership has grown from a couple of hundred to far more than a thousand, comprising men like the head of the steel trust, and others in the Potash and Perlmutter class.

Most, or at least very many, of the small American manufacturers who had an export end to their business when the war began had it "wished on" them. Some foreigner, somewhere, had somehow become interested in their goods and had sent them an order, from which their trade had grown almost without effort on their part. Hundreds of American manufacturers, however, had failed to take advantage of such an opening. Some had even failed or refused to fill orders coming in this way, either because they knew nothing of the business standing of the orderer, or because they were unwilling to take the trouble to ascertain the shipping and tariff rules of his country, or because the domestic market happened to be good and their shops busy. An instance of how these chances are let slip even today is pertinent.

How Not to Export

Every one knows, or should know, that Russia is on the verge of enormous business expansion, once her governmental chaos is resolved into order. The war has waked the nation up and its wants are increasing daily, while the suppression of vodka has greatly increased its means of gratifying them. New enterprises have been started everywhere. Several months ago a Russian, living at some place west of the Urals wrote to an American export agency that he wanted to start a candy-making business and would like to be informed as to the prices of American candy-making machinery. He sent thoroughly reliable bank references as to his financial standing. The agency referred the letter to half a dozen American manufacturers of candy-machinery, one and all of whom replied that they could not quote prices without further information. "Ask your correspondent what size business he contemplates and what type of machinery he wants and what sort of sugar he is going to use and generally all about it and we'll be glad to let him know what the machinery will cost," they wrote, substantially. Here was a man who had plenty of money, who knew little about candy making, but who saw a field for it (sweets are always in demand when alcohol is banished), and who wanted to get some idea of the cost of starting a business. And the American firms snubbed him! His letter took more than two months to come and the American answers will probably take at least two months to go; and they will not give him a particle of information when they do reach him. Before he can write again—if he has any desire to write again—the war may be over and some enterprising German or Britisher may and very likely will have got the foundation for a trade that is likely to become very important.

Fact That Read Like Fiction

Far different was the experience of a Texas motor truck manufacturer—perhaps because motor trucks are faster than molasses or any other sort of candy. This particular manufacturer happened to be in London two or three years before the war. An acquaintance mentioned to him that his firm wanted five motor trucks to send to their branch office in Calcutta and could not get them anything like so quickly as they desired, the British shops all being loaded with orders beyond their capacity. The Texas man promptly offered to furnish the trucks. The Englishman laughed. "Texas!" he jibed. "Send motor trucks from Texas! That's jolly good, don't you know. Why! My dear fellow, you couldn't meet the price or deliver in our time!" The Texan was hipped. "Couldn't we?" he answered. "I'll show you." He got the contract and rushed away to the cable office, hoping to be able to ship by a steamer which he knew would soon leave Galveston. The cable was out of order, and the company was accepting all messages subject to long delay. The Texan filed a message and then hurried across the street and sent a duplicate message by wireless. It beat the cable by two days. The men at the Texas end were also live wires; they got those five trucks to Galveston in two days—in time to catch the ship—and got them to India about a month before the earliest date at which any British firm had been willing to promise them delivered in London. From that starting point the Texan has sold over fifty motor trucks in India.

But he did not stop there. The sale of the five trucks only whetted his appetite. While he was waiting for his trucks to reach London and to make sure that they went on without delay he scurried about and sold two or three more in England. When he got back home he began to send out catalogues. For two years the business limped along, but showed no real profit, and he was about to give it up when he learned of a foreign trade expert, an Italian, who was seeking a post. He engaged him and put him in charge of his foreign business. Today this Texas firm ships motor trucks to all parts of the world—to 34 different countries and does a foreign business of half a million dollars a year at an annual cost of about $25,000. The initial expenditure in working up the business was less than $5,000.

Pianos in the Andes

Another firm accomplished somewhat similar results by a somewhat different method. This firm sells pianos and stands exceptionally high in the domestic trade. Some years ago one of the younger members of the firm, just out of college, took a pleasure trip to Panama and Colombia. While down there he met some charming people who lived in Lima. The head of the family, who kept a music store, became interested in American pianos and asked for a catalogue. The piano man gave it to him and forgot the whole proceeding.

Many months afterwards he received an order for several costly instruments—draft to follow. The older members of the firm looked Lima up on the map and decided that the order was a joke, that nobody there could afford to buy such pianos, even if they ever did arrive. Only when the draft came did they conclude that whatever else the order was, it was not a joke.

Unfortunately the pianos ordered were no longer in stock. Here was a chance to write a lot of letters, like the candy people. But the young partner was of another type. He was willing to take a chance. He sent instruments as nearly as possible like those that had been ordered and wrote to the Lima man that if they were not satisfactory they might be returned at the firm's expense. In reply he received a warm letter of appreciation and an order and draft for more pianos. Since then he has done a big business with the west coast of South America. Moreover, it will be difficult for any one else to get the trade away from him; the Lima man has sung his praises for square dealing all along the coast too well.

Another case of having business thrust upon him was that of a manufacturer who, many years ago, toured down the east coast of South America on a pleasure trip. This man, who makes saddles and harnesses, lives in Kentucky, where they know how to fit out a horse properly. His saddles were beauties. In Rio Janerio he met a resident who was also interested in saddlery and who insisted on placing an order with him. Kentucky tried to sidestep, knowing that his saddles differed from those in vogue in Brazil and fearing that they would not sell there. But his Rio friend insisted. So when he got home he shipped the saddles, after making some superficial changes that made them a less marked contrast to the Brazilian article. Whether for this reason or for some other the saddles sold well, and a profitable business was built up, not alone in saddles but in all grades of horse vestiture. Today Kentucky saddles may be found all over the high grassy plains of Minas Geraes and other great stock-raising states of Brazil.

How to Answer Inquiries

Years ago a manufacturer of coal-mining machinery received a letter from a man in Siberia who wanted to know about his line of goods. The writer had seen the firm's advertisement in a trade journal. The American manufacturer was interested in the inquiry chiefly because of the novelty of its source. But he had heard tales about the coal deposits in Russia and China and Korea and he decided that there might be something in the thing. He was a thorough-going fellow and so he answered in full, not merely sending catalogues and printed matter, but writing a ten-page letter, going into minute details, such as what the machinery weighed, what foundations it must have to rest on, how big the shipping boxes that would carry the parts were and what they would weigh, what the freight would cost, where and how extra parts could be obtained most quickly, and so on.

He sent the letter. About the time it should have reached its destination the Russo-Japanese war threw Asia into turmoil and long before it was over he had forgotten the whole matter. But four years later he received an order with draft for a very complete line of his machinery. Since then the business has had ups and downs, owing chiefly to the political situation and the attempts of the Japanese to keep everything in that part of the world for themselves. But it has never failed to show a yearly profit—in the aggregate a very large profit.

Standardized Cloths for the Suits of British Civilians

CHARLES SYKES, Director of Government Wool Textile Production, recently made an official statement to the Board of Control on the Government scheme for standardized suitings for civilian wear. He said there would be at first one type of cloth made available at a fixed price, but that it would be possible to have a reasonably large variety of patterns in that one grade. It was thought that such cloths could be procured at 6s. ($1.46) per yard, so that the price of a man's suit of standard cloth would be about £2 10s ($12.17); and that provision could be made for a standard shoddy for boy's clothing, so that the cost per suit would be for young boys £1 2s. 6d. ($5.47) and up to £1 10s. ($7.30) and £2 ($9.73) for youths. He hoped also to arrange for standard flannel by requesting manufacturers to conform to a standard specification, the intention being to have the flannel stamped every few yards with the retail price.

It is thought in the British tailoring trade that an important result of the scheme will be the utilization of a better quality of material than can now be obtained in ready-mades. At the present time ready-made suits can be bought for less than £2 10s. mentioned above, but the cloth is of poor quality and the suits are made by the lowest class of labor.

Concrete Shelters Which Weather the Enemy's Artillery Storm

ON numerous occasions we have shown German dug-outs and pill-boxes and other types of shelter, conveying, perhaps, the erroneous impression that such constructions were typically and uniquely German. If so, it has been due only to the fact that the Allies and ourselves, as a rule, prefer not to make public the nature of our defensive works.

But in the accompanying illustration we present a splendid example of our defensive works, in the form of a brick and concrete shelter or "abri," to use the term of the French engineers who constructed it. This structure or shell-proof quarters is provided with a camouflaged concrete roof two feet in thickness, and is prepared to withstand a serious shelling from enemy guns but a few miles away. It serves as a shelter for the operatives of a narrow gage ammunition railway which runs past the entrances.

Copyright, Underwood & Underwood

With a roof two feet thick, this "abri" or shelter offers shell-proof quarters to French railroad workers

Trench Gates and Trench Raids

SPEED is everything in a successful trench raid. Indeed, the duration of a trench raid is always measured in minutes; and if it requires more than a reasonable number of minutes it generally results in the raiders being killed or made prisoner. All of which is perfectly obvious when it is remembered that the raiders only number 10, 20 or even 100 men, while the lines they are attacking contain thousands of men and numerous machine guns and artillery. Once their surprise is over, the attacked are quick to retaliate if by that time the raiders have not returned with their spoils and prisoners to their own positions.

In order to hamper or limit hostile trench raids, trench gates of the type shown in the accompanying illustration are employed at regular intervals along a trench. Normally the trench gate is closed, and any attempt to rush the trench is foiled by the barbed-wire face and stout framework. In this particular instance the directions for opening the gate are given on the board at the left, which would indicate that the combination of iron stakes and rope and chain is somewhat involved.

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Trench gate dividing a British trench into independent sections

High-Angle Fire Artillery—The Backbone of the Austrian Army

THREE and a half years of war have disclosed beyond a reasonable doubt that Austria's armies have at no time established an enviable record as soldiers. Such victories as have been won by the Dual Monarchy have been due either to powerful German assistance, or to combating a small foe, weak in numbers and in materiél. But the one redeeming feature of Austria's armies has been their artillery, especially heavy artillery, in which they have stood high in the ranks of the fighting nations.

The one great reason why the Italians did not overrun Austria and Hungary instead of fighting their way inch by inch in the mountains, is the formidable artillery of the enemy. The Italian reverses were in large measure due to the smothering effect of Austrian artillery; and Italy, fully cognizant of the strength of the adversary in this direction, has ever since been asking her allies for guns rather than men.

The accompanying illustrations are of interest because they depict guns which are typically Austrian. One of these shows three heavy trench mortars of the kind used for hurling several hundred pounds of explosive into the opposing trenches and destroying a wide stretch of intrenched works at one stroke. Because of the low power of the propelling charge required, the walls of the gun barrels are quite thin.

The last illustration depicts three queer pieces of artillery, the exact nature of which is not divulged by their Italian captors. From a close study of the illustration, however, it appears that these weapons are some form of pneumatic trench mortar, with the air reservoir and valve mechanism at the rear. At the left may be seen the ends of two compressed-gas tanks which are employed for replenishing the smaller tanks integral with the gun.

A field howitzer of short range typical of the bulk of Austrian artillery

The second illustration shows an Austrian mortar of probably six-inch bore, mounted on a heavy carriage and provided with recoil mechanism. Small mortars of this kind capable of extreme mobility, have formed the greater part of the Austrian artillery in the field since the early days of the war. Although only suitable for close-range firing, the fire of small mortars of this type is very effective.

The Current Supplement

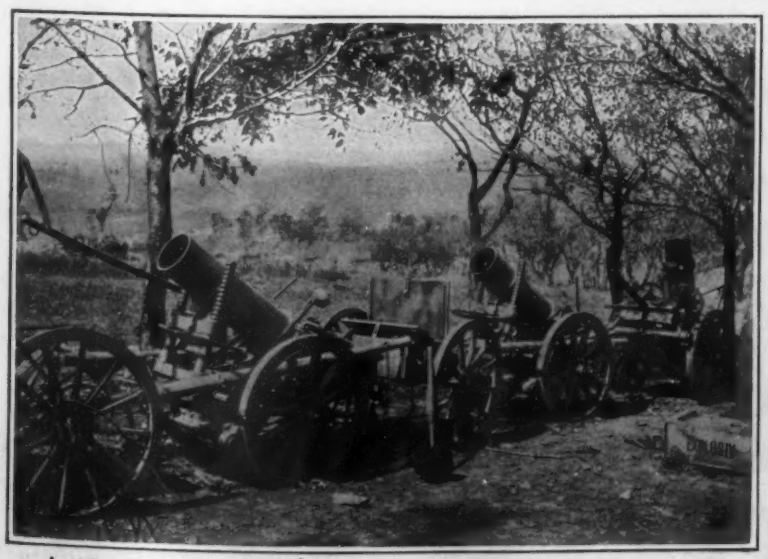
SOMETHING of the character of a race of people may be inferred from a study of their ancient customs, and from this point of view the paper on *The Religion of Ancient Ukraine*, in the current issue of the SCIENTIFIC AMERICAN SUPPLEMENT, No. 2199, for February 23d, will undoubtedly be of interest on account of the position that district of Russia is taking in current affairs. The note on *A Protecting Ditch Fence*, together with illustrations, carries valuable suggestions for regions afflicted by floods. *Periscopic or Altiscopic Rifles* compares some of the devices used by the French and the Germans in their trench fighting, and is accompanied by explanatory sketches. The paper on *The Causes of Disease* is concluded. In the mechanical arts the grinding wheel has assumed an important and indispensable position in the production of accurate and finely finished parts of machines. The article on *Modern Abrasive Wheels* tells how these tools are made, and it is accompanied by a number of photographs illustrating the processes described. *The Utilization of Condemned Army Boots* is an interesting account of a war economy, as practiced in England, and contains valuable suggestions that might be studied with advantage in our country. *Germany's Designs on French Iron Ore* points out one of Germany's schemes of aggrandizement, and which was undoubtedly one of the purposes of the war. The potency of a forked twig for discovering the location of minerals, water, hidden treasures and sundry other purposes has had credence in many lands for centuries, and even today many people in rural communities have faith in its powers. A paper on *The Divining Rod* gives an interesting history of this superstition, and several illustrations show how it was operated. The *Historical Sketch of Convoying at Sea* tells how sea-borne commerce has been protected in years gone by, and will be found of particular interest at this time. Other articles of value include *Nitrogen's Part in Nature; Improvements in Zeppelin Design; Magnetism and Electricity* and *On a Possible Limit to Gravitation.*

Exporting Blast Furnaces

THE exportation of blast furnaces is a new feature of the iron and steel industry. A large blast furnace at Battelle, Ala., is now in process of demolition to be shipped to India. Japan is also seeking to buy blast furnaces in this country. It is likely that before long the sale of five will be effected and this will necessitate the dismantling of them and their transportation to Japan.

The Alabama furnace that is now on its way to India is to be used for making ferromanganese from Indian manganese ores. The moving of this furnace will be one of expedition. The plan involves the dismantling of the stack and the rest of the furnace plant within 60 days and arrangements have been made with the British Government to ship it by special vessel from either Mobile or New Orleans.

These developments are a commentary on the stress for deliveries of iron and steel on the one hand and the difficulty in getting new equipment in the desired time on the other.



Austrian trench mortars of large caliber, mounted on heavy gun carriages to facilitate transportation

A battery of pneumatic trench mortars abandoned by the Austrians while the Italians were still on the offensive

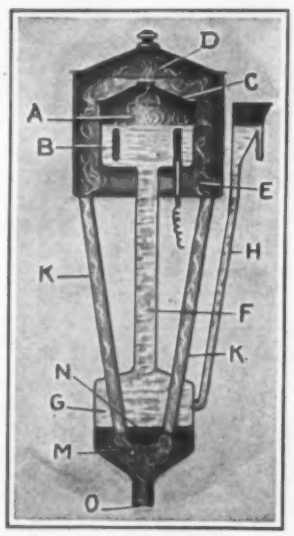
Inventions New and Interesting

A Department Devoted to Pioneer Work in the Arts

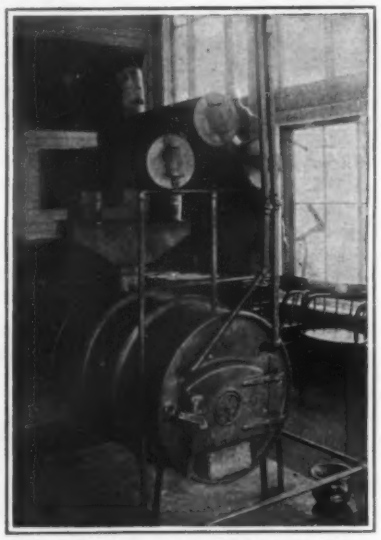
Distilling Liquids by the Electrolytic Method

FOR the distilling of liquids in a simple and expeditious manner, a rather novel electrolytic apparatus has been recently invented by Otto Stalhane of Ludvika, Sweden, and made the subject of a British patent.

The ingenious distilling device is schematically presented in the accompanying drawing. It will be noted that *A* is the distilling vessel, in which the evaporation of the liquid is effected by means of an electric element of circular form, *B*, which, together with the distilling vessel of metal, serves to pass current through the liquid. The vessel is provided with a cover *C* open at the top *D*. The vessel is surrounded by an outer vessel *E* closed at the top. From the bottom of the vessel *E* the pipe *F* extends through the bottom of the vessel *E* and leads into another vessel *G*, provided with a double bottom. The vessel *G* communicates through the pipe *H* with a funnel which is provided with an outlet pipe, so that the level of the liquid in the vessel may be kept constant by continuously supplying the funnel with a sufficient quantity of liquid. From the bottom of the vessel *E* pipes *K* extend downwards, passing through the vessel *G* and its double bottom and opening into the chamber *M* below the bottom *N*. When the liquid is brought to boil in the vessel *A*, the vapors will escape through the opening *D* of the cover, fill the space between the vessel *A* and the vessel *E*, and then pass down through the pipes *K*, where they are cooled and condensed at first by the cooling action of the air surrounding the pipes *K* and thereafter by the cooling action of the liquid in the vessel *G*, which at the same time is heated by the distillation products passing through pipe *K*. The liquid thus preheated in the vessel *G* rises through the pipe *F* into the vessel *A* where it is evaporated. The products of distillation are collected in the chamber *M* and flow away through the pipe *O*.



Application of electrolysis to distilling



Improvised stove in an Alaska hotel, made of a discarded oil drum

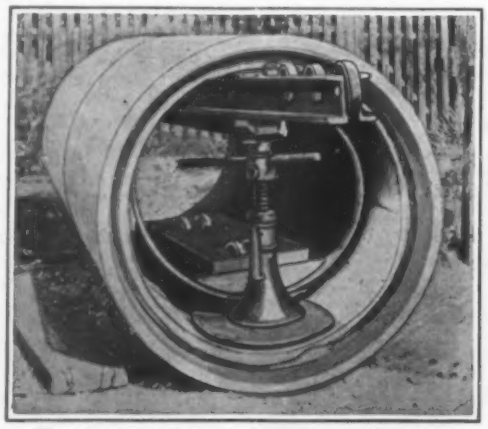
Guide Carriage for Laying Large Sewage Concrete Pipes in Tunnels

By Frank C. Perkins

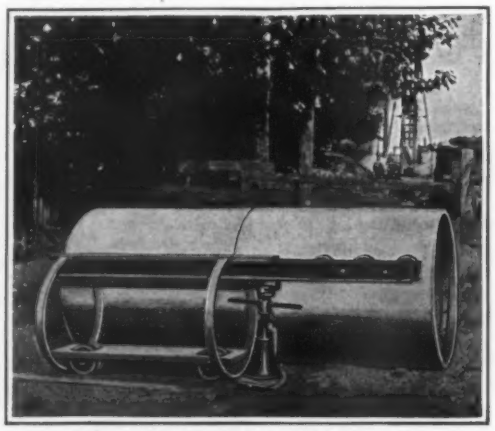
THE laying of large concrete pipes in tunnels with a guide carriage of special design, is shown in the accompanying illustrations. The beam at the top of the carriage is equal in length to two sections of pipe and is made of two 4-inch channels let into the wide faces of a 6 by 8 timber, which is shaped on the top edge to fit the inner surface of the pipe. There are three 5-inch rollers fitted one behind another at intervals of about ten inches in the groove between the two channels, where they project beyond the wooden beam; it will be observed that the tops of the rollers are in line with the top of the wooden beam. The beam is bolted to two angle iron hoops of the proper diameter, which are attached to a small four-wheeled truck. An ordinary screw jack, fitted with a hardwood base shaped to the inner circumference of the pipe, and with a square plate at the top engaging in a slot in the end of the wooden beam, completes the apparatus.

In operation, the carriage is run into the first length of pipe next the working shaft after it has been laid in place, the horn formed by the uncased ends of the channels projecting into the space for the next length. The jack is then inserted in place and screwed up, lifting the entire carriage and jamming the top of the beam against the inside of the pipe. The next length is then wheeled up on a truck and slid on to the channel-iron horn, hanging easily from the rollers. Its position can be regulated to a nicety in a fore-and-aft direction, and it can be brought exactly to grade by altering the screw jack or inserting a bit of packing on the top. As soon as the two lengths of pipe have been made flush at the joint and the second length brought to grade and blocked up, the channel iron horn continues to hold it steady while the joint is being made and the supporting concrete packed in. The jack is then released, and the carriage is moved forward, ready for the next length.

It is stated that the jack-head is usually engaged with the wooden beam so as to be carried with it as the carriage is moved. It can be taken off, however, when a man has to crawl up through the pipes to point the joints. With a larger size of pipe it is best to use two jacks, it is said. With this apparatus about 2,000 feet of 30-inch pipe were laid in tunnel at Vancouver and the engineer points out that any one who has had any experience of the trouble in handling pipe-lengths weighing 1700 pounds in a small tunnel will be able to appreciate the saving of time and labor.



The pipe is easily moved upon the rollers into the exact position



The sewer pipe and the guide used in laying it

When a Kerosene Drum Becomes a Stove

THE multitudinous uses to which empty kerosene cans are put are well known; and even in the remotest parts of the world we find these tin containers in great demand because of the many different forms into which they can be remade for further service. The five-gallon size, it appears, is the most favored, for it can be worked by the average handy man with the crudest of tools. On the other hand, the large drums are not so much in demand. For one thing, the drum is too valuable as a receptacle for petroleum products to destroy, and besides it is found too tough, as a rule, for the handy man about the farm or the ingenious tribesman to knock out of its original shape and into something that meets his special requirements. Nevertheless, it is at times made to serve in ways entirely foreign to the ideas of its designers. A typical case is shown in the accompanying illustration, in which a drum has been remodelled to do service as a stove.

Along the great waterways of interior Alaska drums are often found doing duty as stoves, but it is seldom that their design is as elaborate as that of the one shown. Travelers who have toasted their shins in front of this stove in the "Golden North" Hotel at Skagway, southeastern Alaska, pronounce it a marvelous generator of heat and a noteworthy example of recreative work, says the *Standard Oil Bulletin*.

The Great Loss from Rusting of Steel

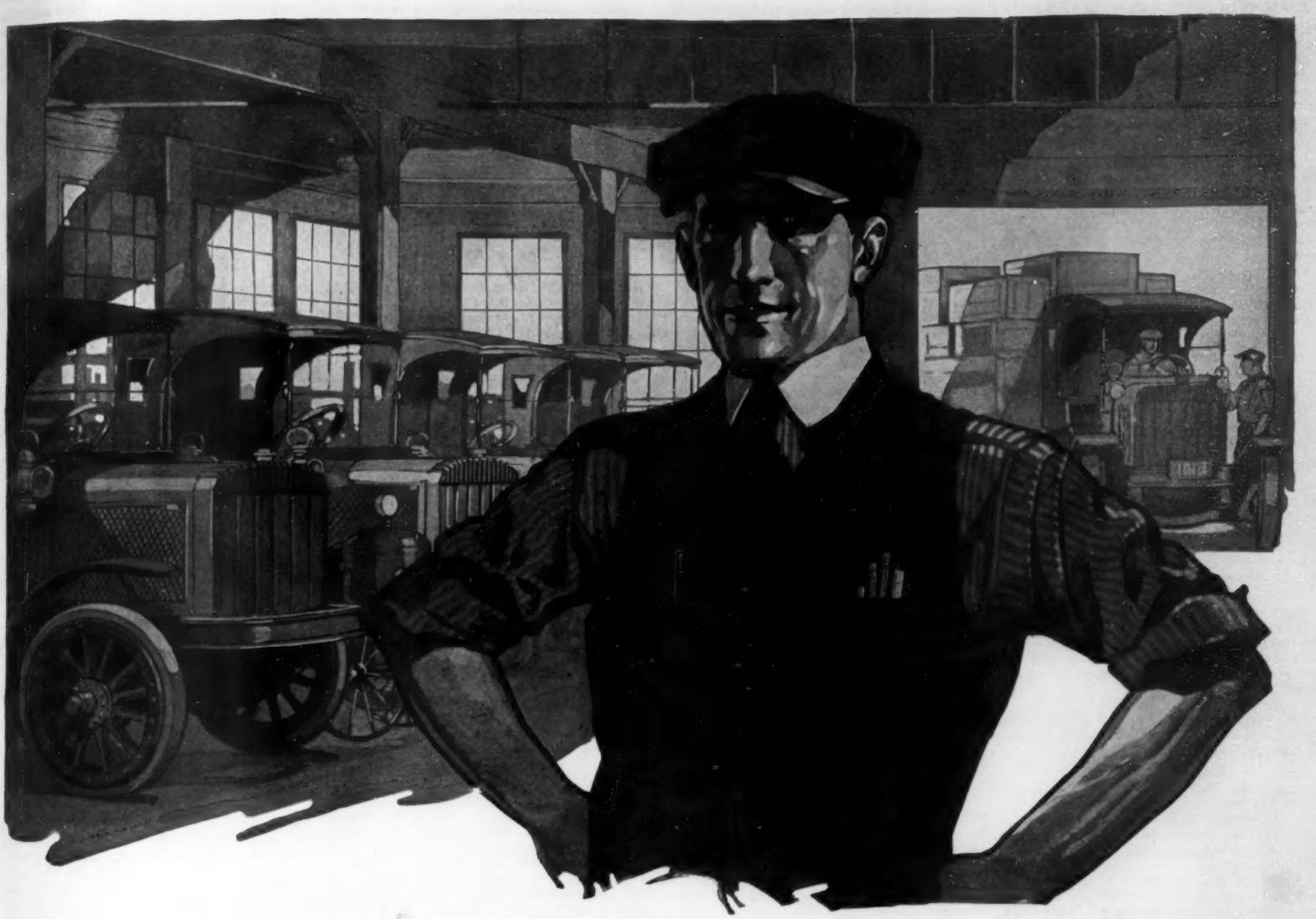
IT is now quite universally admitted that the rusting of iron and steel is one of the serious industrial problems. If we assume an average life of steel to be 33 years, the depreciation charge of three per cent represents, according to the United States Bureau of Mines, a yearly loss of 1,000,000 tons of product in this country for the crude or semi-finished material alone, exclusive of correlated manufacturing costs. The inevitable rusting of steel may be justly claimed to be the mainstay of the zinc industry, as 60 per cent of the metallic zinc used in the States is for galvanizing iron and steel articles, representing an annual outlay of $20,000,000 in an endeavor to protect metals from decay. Enormous amounts of paint are used in a like endeavor. About 5,000,000 tons of coal are needed in the production of steel to replace the annual waste, and 1,000,000 more for replacing the zinc that is annually lost. No estimate can be made of the value of the brass, bronze, copper, aluminum, nickel, tin and other metals and alloys used in machine parts, as sheathing, for plating, etc., to protect steel, or as a substitute for it in places where it would be used, but for its lack of resistance to atmospheric attack.

A baby carriage that eliminates the bump at curb and stoop

Why "Bump the Bumps"?

NOT all of the sensations of "Bumping the Bumps" are confined to some Coney Island or Riverview concession. One has only to be a baby in the ordinary gocart to get all the jolts there are free of cost. If women had the designing of the streets there would be little sloping bridges or platforms built to connect the sidewalk with the street. As it is, in most cities there is a gutter to cross at each side of each street, with a considerable "step-down" at each. Baby gets well shaken and bounced every time his mother-drawn sulky comes to a crossing. The youngster has a second complaint about the men who make things without consulting him. Nearly all the houses are set up in the air with a flight of steps for him to bump up and down every time he goes riding.

But if most of the men were blind to baby's discomfort and the weariness of his mother, one who watched him being lifted over a crossing to save him from bumping saw the light in a practical manner and invented a new gocart with metal glides which enable it to slide smoothly up and down the porch stairs and over the street crossings. If the little fellow's mother stops at the grocery she can leave the cart and youngster outside the window, in sight and in safety, since the glide supports will give the cart stability and keep it from tipping or tilting.



They Make My Job Easier

By the Fleet Boss

"We run this fleet for profit — not for pleasure.

"It's my job to see that every truck starts out every day with plenty of oil and gas, radiator full, grease cups attended to, all nuts and bolts tight and all adjustments right.

"We want that truck to stay on the job and to keep on delivering the goods all day and when necessary all night.

"I don't propose to have delays and breakdowns due to oversight on my part or to faulty construction that could have been remedied.

"Timken Bearings, like other dependable, well built, time tested parts — make my job easier.

"They never give me a minute's worry. I know they won't bring in a bill for repairs or replacements, by wearing loose, because their adjustability enables me to get the jump on the wear.

"So long as they are properly lubricated and adjusted they simply don't wear out, even under the hardest service. Hubs run true and gears are kept in perfect mesh all the time.

"And all I do is give the bearings fresh grease and a part turn of the adjusting nut every few thousand miles.

"Good bearings mean that your running gear and driving mechanism is in good order and safeguarded against wear, and that means daily earning capacity and profits for the truck 'owner'."

Just by way of checking up on what the fleet boss thinks of Timken Bearings ask any man you know who operates a truck fleet — and write for the booklet D-3, "The Companies Timken Keeps," which will give you an idea of the extent to which Timken Bearings are used on the best known and best built American trucks and passenger cars.

THE TIMKEN ROLLER BEARING CO.
Canton, Ohio

TIMKEN BEARINGS

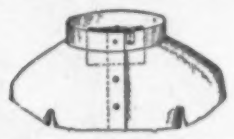
RECENTLY PATENTED INVENTIONS

These columns are open to all patentees. The notices are inserted by special arrangement with the inventors. Terms on application to the Advertising Department of the SCIENTIFIC AMERICAN.

Pertaining to Apparel

GARMENT.—L. STRAUSS, care of Knitwear Mfg. Co., 114 Fifth Ave., New York, N. Y. Among the principal objects which this invention has in view are to prevent sagging or stretching of a knitted garment, to preserve the shoulder and collar dimensions of a garment, and to preserve the uniform character of the construction of the garment while accomplishing the objects above stated.

VENTILATING ATTACHMENT FOR SHIRT NECKBANDS.—R. H. GRAY, 1111 University Ave., Columbia, Mo. This invention is a device adapted for attachment to the inside



FRONT PERSPECTIVE OF A SHIRT WITH INVENTION APPLIED

of neckband of a shirt to provide for ventilation or circulation of air, by holding the neckband away from the neck of the wearer, so that air heated by contact with the body may rise and escape under the collar, thereby conducing greatly to the comfort of the wearer of the garment when the temperature is high.

LADY'S GARMENT.—JENNIE G. FOWLER, 919 Fairview Ave., Salt Lake City, Utah. The invention relates particularly to a semi-undergarment for the protection of the arms in cold weather, under lace waists, or other gauzy material, the object is to provide a warmth-giving covering in the nature of tight-fitting sleeves, having extensions adapted to be connected across the body of the wearer in order to firmly hold the sleeves in position in use.

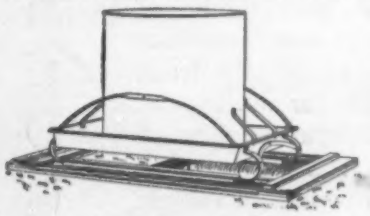
Electrical Devices

ALTERNATING CURRENT TELEGRAPH AND TELEPHONE DUPLEX.—J. P. FERRITER, 305 Field Signal B, Camp Lee, Va. A general object of the invention is to provide a reliable and efficient alternating current telegraph and telephone duplex which is adapted to operate on wires already in use, such as telephone circuits or direct current, single or multiplex telegraph circuits, or on a circuit used for no other service. A more specific object is the provision of a junction coil of special construction, especially adapted for duplex work with a high frequency alternating current.

TELEGRAPH CIRCUIT CLOSING AND SIGNALING SYSTEM.—F. A. ANDERSON, 618 Mulvey Ave., Winnipeg, Manitoba, Can. An object of the invention is to provide a system by means of which a telegraph circuit at a local office which is open, as for instance when the switch is left open, the relay wire broken, or from any other cause, may be closed from a central office. A further object is to provide a system in which signals will be sent to the central office indicating the particular local office at which the open circuit or break occurs.

Of Interest to Farmers

HEATING SYSTEM FOR DRINKING-FOUNTAINS.—J. W. CAMPBELL, care of Adams Public School, Adams, Neb. An object of this invention is to provide a heating system, incorporating the use of a housing to be built up around the drinking pan of the fountain for maintaining the heat around the pan, created by a lamp dis-



A PERSPECTIVE VIEW OF A FOUNTAIN, TO WHICH THE INVENTION IS PARTICULARLY APPLICABLE

posed beneath the same in such manner that even during the coldest weather the water in the pan may be maintained above freezing temperture, and at a small expense. The invention can be applied to drinking fountains for poultry, swine and the like.

CORN HUSKER.—G. L. MILLER, Geneseo, Ill. The invention has for its object the provision of a device, wherein a plate is provided curved in such a manner as to conform approximately to the shape of the ear, and arranged within the fingers, the palm, and over the bale of the thumb, and having means for assisting in firm grasp of the ear, and wherein the fingers and thumb are left free.

HOG TROUGH.—M. J. HOSCH, address Clarence B. Willey, Atty., Randolph, Neb. The object of the invention is to provide a trough wherein the ends are extended and plates are pivoted between the ends to normally hand vertical position at the center of the trough, other mechanism being provided for swinging the plates outwardly in line with the edges of the trough to close it during the insertion of food, one end of the trough having a feed opening.

TRENCHING PLOW.—F. B. CURRIER, 252 Grant Ave., Jersey City, N. J. Among the objects of this invention are to provide a combination of cutters for cutting out a strip of sod to form a trench without danger of the plow clogging with meadow grass, and to provide sod cutters in front of the strip cutters which serve to guide the machine and to cut the sod directly in line with the vertical blades of the strip cutter, so that the danger of clogging the plow with grass is eliminated.

ATTACHMENT FOR HEADERS AND HEADER-BINDERS.—D. E. HURTIG and F. L. HAGGART, Delphos, Kans. The general object of the invention is to provide mechanism of the character specified capable of being attached to existing machinery of the harvester type, as for instance, headers and header binders for connecting the wheels of the harvester to a motor and thus transform the harvester into a self-propelled machine.

Hardware and Tools

ADJUSTABLE REAMER.—S. H. NORTON, address McCroskey, Reamer Co., Meadville, Pa. The present invention relates particularly to an adjustable reamer, the general object being the provision of a device involving a construction whereby the cutters may be effectively secured and clamped adjacent their forward outer ends and a compact arrangement involving a minimum number of parts is at the same time promoted. A further object is to provide special parts whereby an effective small reamer may be manufactured at minimum cost.

SPOOL FOR SUPPORTING WIRE.—L. W. BARKER, R. F. D., No. 1, Arrington, Kan. The invention has for its object to provide a simple spool for supporting wire, as for instance barbed wire, the device is adapted to be journaled upon a rod, wherein mechanism is provided for holding the spool from rotation, and for controlling the speed of rotation of the spool.

PERMUTATION LOCK.—B. SNYDER, address Julia Wolf, 51 St. Marks Place, New York, N. Y. An object of the invention is to simplify the construction of permutation locks, to allow of cheaply manufacturing the lock and readily assembling the various parts thereof without requiring highly skilled labor. Another object is to permit convenient application of the lock to suit cases and other articles with a view to prevent opening thereof by unauthorized persons.

COMBINATION SPRING TOOL-HOLDER.—M. SCHONBRUNN, 509 E. 77th St., New York, N. Y. The invention relates to lathe tool-holders the general object is to provide the construction and operation of devices of this character so as to be comparatively inexpensive to manufacture and so designed as to permit of a large variety of operations with only one holder and interchangeable cutter or tool-carrying posts. A more specific object is to provide a lathe tool-holder with an offset shank, formed with a vertical opening in which is reversibly clamped a vertical spring post which carries the cutter.

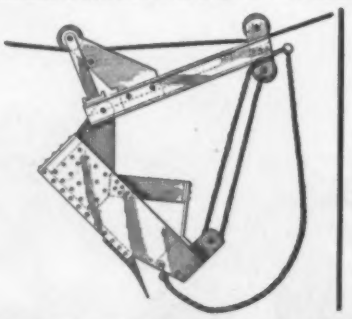
CUTTING TOOL.—A. BOCK, 140 Richmond St., Brooklyn, N. Y. The invention relates to cutting tools such as are used in pneumatic hammers or held by a stone mason or sculptor while operating on marble, granite or other stone. The object is to provide a cutting tool arranged to dispense with all blacksmith work for re-shaping and resharpening purposes and to allow effective use of the cutter until worn down to a short stem.

Machines and Mechanical Devices

DRYING MECHANISM FOR PRINTED MATTER.—T. J. BEREGH, Jr., care of Charles F. Press, 8 34th St., Printing Crafts Bldg., New York, N. Y. Among the principal objects which this invention has in view are to avoid smudging of print surfaces on multiple impression presses, to avoid the use of offset webs in multiple cylinder presses, and to provide a simple and efficient apparatus for drying printed surfaces as they are delivered from the type bed.

DEVICE FOR DRIVING THE IMPRESSION-CYLINDER OF PRINTING MACHINES.—C. WINKLER, Berne, Switzerland. The invention relates to a device to be used on printing machines for enabling the toothed parts connecting the form and impression cylinder to be kept in engagement with each other even when the impression cylinder has been moved radially away from the form.

EXCAVATING MACHINE.—C. F. RAYBURN, Interstate Mine, Wallace, Idaho. This invention relates to an excavating machine of that type in which the digging and transporting mechanism is operated from a distance by means



A SIDE VIEW SHOWING THE PARTS IN DUMPING POSITION

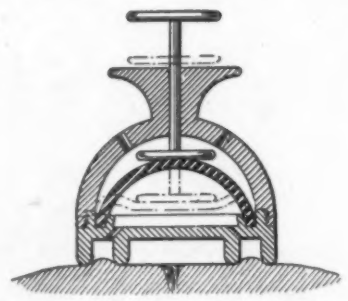
of a drag line and is suspended during its journeyings, and has for its object to provide mechanism wherein the digging and the dumping are accomplished without the use of tripping mechanism or the like.

OFFSET FOR SAWMILL CARRIAGES—C. M. MADSEN, Sunburst, N. C. The invention relates to carriage offsets employed on the carriages of single cutting band saws to cause the offsetting movement as the carriage reverses in order to move the log away fr m the band saw so that in case a sliver should be on the sawed side of the log, it will not catch on the back of the saw and pull it off the band wheels.

CLOCK STRIKING MECHANISM.—M. DOWLIN, Henniker, N. H. The object of the invention is to provide a clock striking mechanism of few and simple parts, adapted for use in connection with any suitable make or model of striking clock and by means of which a clock so provided will sound full hours in distinct, definite, unmistakable, appropriate and pleasing sounds to correctly indicate the time of day or night.

Medical Devices

EMERGENCY WOUND CLOSER.—H. M. MAGILL, 417 N. Greenwood Ave., Tulsa, Okla. This invention relates to an emergency surgical appliance to prevent excessive bleeding in a small wound when a blood vessel has been punctured, it is adapted to be used until proper medical



CENTRAL VERTICAL SECTION OF THE DEVICE

treatment can be obtained. A more specific object is the provision of a cup device which creates a suction on the skin in an annular or elliptical line surrounding and spaced from the wound, whereby the device is firmly held in place while the inner chamber or cup of the device over the wound holds the blood which coagulates.

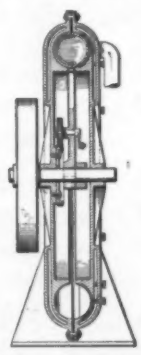
Musical Devices

PIANO.—V. BESSIER, 2612 Atlantic Ave., Brooklyn, N. Y. The invention relates to upright pianos, and its object is to provide a note and sounding board extension arranged to permit the use of additional strings in the treble and to increase the sounding area of the sounding board at the treble with a view to insure a fuller and clearer tone on sounding the treble strings and without resorting to an increase in the size of the frame and string plate.

PLAYER PIANO.—T. HOLVERSON, 1222 North Carolina Ave., N. E., Washington, D. C. The object of this invention is to provide mechanism for connecting the pneumatics with the wind trunk in such manner that any individual pneumatic may be removed without disturbing the others should such removal be necessary for any reason. The mounting of the player action is small and compact, permitting the removal of the keys without interferring with the player action.

Prime Movers and Their Accessories

INTERNAL COMBUSTION ENGINE.—S. H. GRIMMETT amd F. GOETTE, Caldwell, Idaho. This invention has for its object to provide a device of the character specified, wherein an annular chamber is provided, in which moves the



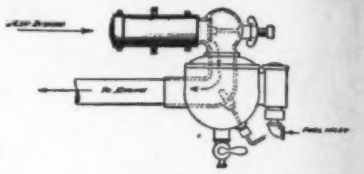
A VERTICAL SECTION OF THE ENGINE

cylinder and the piston, the cylinder and piston being so connected that they will have relative movement toward each other to compress the charge during their movement in the chamber.

ROTARY ENGINE.—E. TANNER, care of Aviation School, No. 1, San Diego, Cal. This invention relates to rotary engines of the gas driven type. An object is to provide an engine in which the shaft is stationary, and in which the cylinders and the casing revolve, the engine being provided with opposed cylinders, thereby allowing more cylinders to be placed in a given space. A further object is to provide an engine in which one connecting rod serves two opposed pistons, thereby allowing shorter and lighter pistons to be used.

INTERNAL COMBUSTION ENGINE.—M. SIEVEKING, 75 E. 81st St., New York, N. Y. The invention relates to a two-cycle internal combustion engine, its object is to provide an engine in which the usual inlet valves are eliminated, and wherein compression cylinders are used in lieu of inlet valves. A further object is to provide a structure having a divided cylinder having a plurality of explosion chambers with a piston in each chamber so that in at least some of the chambers perfectly pure combustible matter may be positioned upon each compression to positively insure explosion on each revolution.

CARBURETER ATTACHMENT.—L. B. HARROD, care of Linden Hotel, Indianapolis, Ind. The particular object of this invention is to provide means for heating the air coming through the air intake of a carbureter thereby facilitating

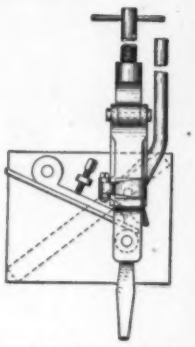


SIDE VIEW OF THE DEVICE AS APPLIED TO A CARBURETER

the starting of the engine with which the carbureter is associated. A further object is to provide an attachment to the carbureter which is simple in construction but by means of which the incoming air may be heated through electrical means, at the will of the operator.

Pertaining to Vehicles

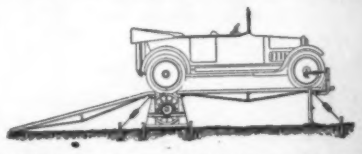
DEVICE FOR FORMING EYES ON SPRINGS.—F. J. KITOWSKI, St. Cloud, Minn. This invention is particularly intended for embodiment in a device for forming eyes of different sizes on the springs of automobiles and other



PLAN VIEW OF THE DEVICE, PARTS BEING BROKEN OUT

vehicles, although capable of forming eyes on articles other than springs. An important object also is the strength and efficiency as well as simplicity in the adjustment of the device to produce eyes of varying character, the forming pin is interchangeable according to the size of the eye, and is held in place by a novel latch piece.

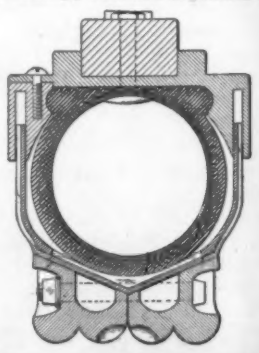
POWER TRANSMITTING DEVICE.—J. S. WALLACE, DEC'D, address E. E. Devol, Burlington, N. D. The invention relates to power transmitting devices in which an automobile can be employed as the prime mover for transmitting power for any desired purpose. The general object



A SIDE VIEW OF THE DEVICE WITH THE AUTOMOBILE READY FOR ACTION

is to provide a device which is portable so that it can be readily taken apart and loaded into an automobile and transmitted for service, the device being easily set up, without the necessity of digging a pit, and the transporting automobile used on the device for generating the power.

COMBINED PNEUMATIC AND STEEL TIRE.—J. BLAIR, Jr., care of C. A. Blair, 102 2d St., Rock Springs, Wyo. This invention relates to a type of tire in which is comprised a pneumatic inner tube and casing, or an equivalent cushion tire, together with metallic protective elements floatingly sustained in position on a rim



CROSS SECTION SHOWING STEEL TREAD BANDS

by the pressure of the expanding inner tube. Among the objects of the invention are to provide a tire in which the protective elements will be afforded freedom of movement in any direction in the plane of the tire relatively to the rim, and to prevent injury to the inner tube and its casing by the movements of the protective elements.

Designs

DESIGN FOR A DESK CABINET.—E. P. FRAWLEY, 203 W. 138th St., New York, N. Y. The design relates to a desk cabinet, divided into various compartments, it is provided with a lid, and lock, for the protection of the articles enclosed, also with sliding extension for the display of articles.

(Concluded on page 176)

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RECENTLY PATENTED INVENTIONS

(*Concluded from page 174*)

Of General Interest

FOLDING UMBRELLA.—A. BLOCK, 30 W. 120th St., New York, N. Y. The object of the invention is to provide an umbrella which can be readily opened and closed and when not in use can be folded into a comparatively small bundle which can be readily carried in a pocket, lady's hand bag, traveling bag, valise or the like.

SAFETY-RAZOR.—C. R. BURKE, 6856 Cornell Ave., Chicago, Ill. This invention relates to safety razors of the reciprocating type. The object is to provide a simple, inexpensive and efficient razor which is characterized by the provision of a top or cover plate which relieves pressure on the reciprocating blade when the razor is in use and also serves as an additional guide for the razor.

ANCHOR.—J. E. GARVIN, 285 Hamilton St., Albany, N. Y. The invention relates to means for anchoring the guy rods of telephone poles or the like, the object is to provide an anchor that may be employed as a substitute for wood or metal anchors, the present anchor may be formed of burned clay and be given a design that will afford a large working surface in contact with the sides of the anchor hole, it may be utilized in cylindrical or irregular holes.

SKATE.—J. H. KESSLER, 37 Burd St., Nyack, N. Y. The object of this invention is to provide a skate arranged to facilitate the execution of fanciful curves or sudden turn about movements or momentary stops, as is required in dancing fancy skating, playing hockey and other games. Another object is to aid beginners in learning to skate, with a reduction of the danger of falling.

EVAPORATOR.—D. COZZOLINO, La Cresenta, Cal. The invention relates to evaporators particularly adapted for the evaporation of foaming liquids. An object is to an evaporator in which the foam of the liquid is prevented from rising to the vapor outlet. Another object is to provide an evaporator in which the foam of the liquid is caused to collapse near the surface of the liquid to be evaporated so as to decrease the resistance to the flow of the liquid vapors.

LANTERN SLIDE MAT.—F. A. APFELBAUM, 1560 Broadway, New York, N. Y. Among the principal objects which this invention has in view are, to provide incorporating in the structure of a side for showing on the screen, the name and address of the owner of the slide, to provide mats for slides having stenciled therein the designating marks or symbols, and to provide a structure for accomplishing the object, which is simple and efficient.

SEPARABLE LINK CUFF-BUTTON.—C. E. SKOOG, Providence, R. I. The principal objects of the invention is to increase the service period of buttons of the character mentioned, to adapt a button of the one-piece construction to the needs of an auxiliary spring grip, and to avoid wear on garments with which buttons of this character are associated.

ANIMAL TRAP.—J. E. RUBY, Keancora Flats, 1200 College Ave., Indianapolis, Ind. This invention relates to animal traps having one or more spring-pressed jaws The object is to provide a trap which is simple and durable and arranged to automatically lock the jaws when moved by the operator into active or inactive position. Another object is to permit of setting the trap without the operator using the hands.

BEATER FOR CARPETS, RUGS AND SIMILAR ARTICLES.—L V. S. SEIJAS, 33 Feronia Way, Rutherford, N. J. The object is to provide a beater especially designed for beating carpets and rugs while in position on the floor, wall or other support, and arranged to insure a thorough beating action without requiring undue physical exertion. Another object is to provide a portable beater which takes little room when not in use.

GARDEN HOSE ATTACHMENT.—W. L. DINSMOOR, 1600 California St., San Francisco, Cal. This invention pertains to means for supporting a garden hose to optionally position the nozzle at different locations and in various angular adjustments. An object is to utilize the weight of the supported hose and nozzle to automatically lock the nozzle in a given angular adjustment, and maintain the locked engagement of the parts by the said weight.

SLIP RING.—J. TEPFER, care of The Universal Metal Spinning Co., 383 W. Broadway, New York, N. Y. The object of the invention is to provide a simple and inexpensive slip ring formed of a single blank, the central part of which is punched to form the tubular portion, the margin of the blank being used to form the collar. To form the ring, two operations only of the punch are required. The resulting ring is very light and rigid, it is a unit in itself.

PIPE BOWL CLEANER.—W. R. GROCOFF, 414 4th St., Emporium, Pa. The invention relates particularly to means for scraping the interior of smoking pipe bowls. Among the objects are to provide a cleaning device of a simple and neat construction which may be carried in one's vest pocket with occupancy of a minimum amount of space.

TRUNK ROPING DEVICE.—E C. REYNOLDS, Mineola, L. I., N. Y. The prime object of the invention is to provide a tying means employing a rope, string or like flexible strand formed into loops at right angles to each other with means co-acting therewith at the intersection of the loops and arranged to permit of the tightening of the strand and the fastening of the free ends thereof with facility and dispatch.

LIQUID LEVEL GAGE.—T. WALKER, 1457 2d St., Louisville, Ky. Primarily the object of the invention is to provide a gasoline gage of the type in which the hydrostatic head of the liquid in the fuel tank determines the position of a liquid in a gage glass, the two being connected by means of an air tube, the novel feature being the provision of means by which the error in reading of the gage glass, due to differences in temperature, is rendered negligible.

FISHING TACKLE.—J. S. TUKEY, Belgrade, Me. This invention has for its object to provide mechanism to be arranged between the line and hook, for permitting the hook to yield with respect to the line, and to turn with respect to the line, and wherein said means will act as a sinker for the hook.

ROOF CONSTRUCTION.—J. H. GRIFFIN, 506 W. 26th St., New York, N. Y. Among the principal objects which the invention has in view are, to prevent leakage incident to the accumulation of water between the outer and inner members of a roof, to avoid injury to roof construction incident to the action of frost or accumulated moisture, and to provide a water-resisting removable surface covering for structures.

SHOE HEEL.—W. FELSTEAD, 2784 Cedar Hill Rd., Victoria, British Columbia, Canada. The invention relates to heels adapted to substitution in a simple manner not requiring the services of an expert shoe repairer, the main object is to provide heels of a relatively stiff material extending upwardly around the rear of the shoe upper to support the shoe counter, as well as being forwardly directed to retain the shoe in shape at the sides of the arch of the foot.

RANGE FINDER.—A. C. TUBBS, P. O., Boicourt, Kans. An object of this invention is to provide a focusing device which may be used with an ordinary telescope, and which is simple in construction, has few parts and is therefor not easily liable to get out of order, and which will give the range accurately for any distance to which the telescope can be clearly focused. A further object is to provide a range finder operated by the necessary focusing of the device, and which when the device is in focus, will give the range on a dial carried by the device.

CONVERTIBLE ROLL-FILM CAMERA.—R. S. BURDETTE, 1401 Ave. D., San Antonio, Texas. Among the objects of the invention is to provide a simple and reliable means for adapting a kodak, or standard roll film camera of any known make or design for use with roll films made for smaller cameras without in any way marring the camera or interfering with its intended operation with the full sized film for which it was built.

FIRE PREVENTING ATTACHMENT FOR MOVING-PICTURE MACHINES.—J. L. and I. J. ULMER, address C. W. Morris, 422 Paul Jones Bldg., Louisville, Ky. A specific object of the invention is to provide a shutter device for the hood of the lamp house of moving-picture machines, the device is normally held open by a member having a running connection with the film, so that should the film break the electric power will be automatically cut off from the machine, the shutter device, switch and film-engaging member, forming an attachment which can be readily applied to machines already in use.

NURSING BOTTLE STOPPER.—F. S. RICHARDS, 117 Perin Ave., Warren, Pa. The invention relates to the feeding of infants, the main object is to provide a sanitary bottle from the bottom of which the milk is drawn, thereby avoiding the necessity for tipping the bottle as with the conventional bottles now in use. A further object is to provide a stopper, nipple, and suction tube in readily separable parts for individual cleansing.

AIRPLANE.—K. H. PIESCH, 1814 4th St., New Orleans, La. Among the objects of this invention are to provide a hull of boat form which is watertight and may be made airtight, which is provided with a plurality of independently operated propellers arranged in sets on opposite sides thereof and each of which is on a mount which may be rotated on a horizontal axis transversely of the hull whereby the positions of the propellers may be altered to propel the vessel in the air or in water, to instantly stop the vessel, or turn it in a circle of very short radius, or to hold it motionless in the air.

RECORD FILING CASE.—H. JERUM, care of F. Jerum, 66 Lewis St., Brooklyn, N. Y. The object of the invention is to provide a record filing case for phonographic disk records and arranged to allow storing a large number of records in a comparatively small space and to permit of conveniently removing any one of the records or replacing them whenever it is desired to do so.

DUSTER.—J. S. ROEDER, 1260 E. 40th St., Brooklyn, N. Y. The object of the invention is to provide a dusting cloth which will allow the user to readily reach corners, narrow spaces and crevices in furniture and other articles. In order to produce this result, use is made of a stick, and a dusting cloth held on the stick at a distance from the outer end, a covering of soft material inclosing the outer end, to permit the cleaning of narrow spaces, the duster may be readily removed for washing when necessary.

BOX CONSTRUCTION.—J. A. NONES, 35 E. 12th St., New York, N. Y. This invention relates to glass show cases, display boxes, and similar constructions in which glass plates are fastened to metallic members. The object is to provide a box construction arranged to permit of securely fastening the parts, without requiring the drilling of holes in the glass plates, posts or other parts, at the same time dispensing with mechanical fastening means such as clamps, screws and the like.

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The World in Miniature

(Concluded from page 169)

mediately began on the miniature factory; a wood base was made to the shape and size of the foundation and first floor, and wooden frames covered with compoboard on either side were used for the remaining three floors. Pilasters were milled out of white pine with cut-outs to receive the floors, while floor columns were turned of the same material and placed in proper position between floors and ceilings. All surfaces were given two coats of shellac; the interior was painted a cream color and the floors a concrete color, and the exterior given a heavy coat of varnish with sand applied while wet, so as to simulate a rough concrete facing when finished off with three coats of a flat-finish concrete-colored paint.

The convincing brick-work panels, which appear in one of the accompanying illustrations, are a typical product of the model-maker's ingenuity. Because of the number of panels required, a special mold was prepared. Each panel is cast of plaster of paris with a reinforcement of copper-wire screening, and the proper shade of red is then applied with a rubber roller. In this manner the white of the paster shows where the mortar between the bricks is supposed to be, and the general effect is quite realistic. The same can be said of the windows, which are cast of soft metal in bronze molds, in suitable sections.

With the factory building more or less completed, the various machines were installed. Each machine was placed in position on the floors and secured with screws and bolts, while the hangers and shafting were placed on the ceilings and connected with their motors and pumps and other machines by means of belts and chains.

The piping system, which is rather complicated, was next installed. Far from being a plumber's job, this work was executed in wooden dowels to represent the pipes, with one-eighth inch brass elbows and tees. White lead pipes were painted white, steam red, linseed oil yellow, water blue, and waste pipes green, so that one can follow the flow of material all the more readily.

The tubs or vats of the model factory were spun in sheet brass and painted according to the same color scheme as the plumbing, in order to indicate their supposed contents. Crushers, screens, hoppers, shakers were made of wood and compo-board and heavy bristol board, while brass escutcheon pins were used to represent rivets in the sheet steel construction about the elevators and the hoppers. All such small articles as telephones, hand-wheels, valves, shovels, and hand trucks were cast of linotype metal in plaster molds, and reinforced with hemp to keep them from cracking under the heat.

The box car on the siding appearing in one of the views, was made of mahogany, with trucks and wheels of cast iron. In order to secure the board effect of the conventional freight car, each side was scored at regular intervals on a small table saw.

But the manikins seen in the various views called for the greatest skill, according to Mr. Rook. To make the little men dressed in white and shown at their various occupations, photographs were taken of men at the works. From these photographs the model-maker fashioned the little men in plasterine, and when the desired shape was attained, piece molds of plaster were built about each. Then the molds were filled with melted beeswax and when the latter hardened, the manikins were painted. Being made of wax, the manikins could be slightly heated and remodeled in order better to prepare them for their occupations in the miniature plant.

When completed the model was shipped to the United States National Museum at Washington, D. C., where it can now be seen and studied by anyone interested in the manufacture of white lead.

Not unlike the commercial artist, the model-maker's task is to tell a story in an interesting and effective manner. Both must appeal to the eye. Primarily, the model-maker must be an artist; also, he must be a mechanic, a sculptor, an inventor—in short, an all around handyman.

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The Three-Decker and the Dreadnought

By Percival A. Hislam

THE nations engaged in the war screen their shipbuilding programs with veils of varying degrees of penetrability; but although it is well known that some of the more important naval powers have not abandoned the construction of capital ships the main sea problem for the immediate future—and, indeed, as far as one can see it—is the baffling of the submarine. There are two vital ways in which shipbuilders are contributing towards this—by building one class of ships to sink the submarines, and another to replace the ships which the U-boats sink; and if it should ever be decided that the only real solution of the problem was to seal up or destroy the bases from which the latter emanate, it is clear that large numbers of special ships would have to be built for the purpose, since it is one that no ordinary type of ship is fitted to tackle.

Under the urgent demand for the fighting line and auxiliary services, labor, especially in England, stands out as the most pressing of all problems connected with shipbuilding, though the shortage of material (itself a backwash from the shortage of labor in the mines) is also a serious factor. Few people realize the amount of labor that goes to the construction of a modern battleship. In a most informative book published in England 70 years ago ("An Epitome of the Royal Naval Service"), some interesting but obviously incomplete details were given of the work involved in the construction of the various types of warship then in vogue. After an intimate account of the details and equipment of a first rate sailing ship of the line—the "Queen," of 120 guns and a load displacement of 4,609 tons—it is stated that the number of men required to build such a ship in 12 months was 160 in time of peace and 200 in war time (but there was no explanation of the difference), while "to furnish her aloft it will take 20 riggers 300 hours, or 30 days at 10 hours a day." The entire cost of the ship and her equipment was given as £117,199 (say, $585,995, much less than the cost of a modern destroyer), of which labor was set down as accounting for only £15,643 ($78,215); but as this included the wages of only shipwrights, caulkers, joiners, smiths and painters, it will be seen that the estimate covered only the cost of putting the ship together, and not all of that. There was, for instance, no allowance whatever for the cost of the rigging or the guns.

In the case of a third-rate ship of 74 guns the number of men required to "build" in 12 months was given as 97, while the author was so conscientious as to give, in the case of a sixth rate of 26 guns and 500 tons, "35½" men to build her in 12 months. It is unfortunate that the author gives no clue as to how these figures were arrived at; but he quotes a contemporary report by the Commissioners of Woods and Forests to show that 57 acres of properly planted timber were required for the building of a 74-gun ship, in the construction of which 2,000 oak trees were consumed.

So far as I am aware there has been only one authoritative statement in recent years on the amount of labor involved in the building of modern ships of war. In 1909, Mr. McKenna, then the British First Lord of the Admiralty, said that 70 per cent of the cost of a dreadnought was spent in the payment of labor, and he added that assuming 35 shillings a week as an average wage for workmen of all grades, "the sum of money spent on building a dreadnought represents the continuous labor during two years of some 7,000 men." He concluded with the proviso that the Admiralty had no precise information, but that the figure he had given might be taken as a reasonable approximation.

In 1909 the British navy was building the "Hercules" and "Colossus," battleships of 20,000 tons, and the standard time for building was two years from the laying of the keel-plate. If the time for building remains constant it necessarily follows that the aggregate of labor employed must increase with the size, power and general equipment of the ship. For instance, the "Pennsylvania" is just about twice the tonnage and the horse-power of the "Michigan," and, apart from minor weapons, carries twelve 14-inch and twenty-two 5-inch guns as against eight 12-inch. It is unlikely that the "Pennsylvania," especially allowing for her more complicated and scientific equipment, could be built in the same time as the "Michigan" by less than twice the number of men. To "build" in this case does not mean simply putting the ship together in the dockyard, but the manufacture and installation of everything from the finest detail of the wireless to the great guns.

If the British ratio holds approximately good—7,000 men for a ship of 20,000 tons—it will be seen that 12,250 men would be required to build a battle-cruiser of the "Constellation" class (35,000 tons) in two years, and 14,910 to build in the same period a battleship of the type which Chief Constructor David W. Taylor said would be laid down this year—vessels of 42,600 tons and 23 knots, armed with twelve 16-inch guns. It must be remembered, too, that the tendency nowadays is to accelerate the rate of construction in order to get ships into commission at the earliest possible moment. At the same time, there is necessarily a limit to the number of men who can work on the same job at the same time—even on putting a ship's framework and hull together; but this is counterbalanced by the possibility, almost universally exercised today, or working continuously in three shifts.

It Should Have Frozen—But It Didn't

AS most motorists know, a mixture of denatured alcohol, water, and a little glycerine is recommended for use in the radiator during cold weather. Here follows a table of the various strengths of solution, showing their freezing points and specific gravities

Strength of Solution. (Per cent Alcohol by Volume)	Freezing Point. Degrees Fahr.	Specific Gravity
10	21	.986
20	10	.974
30	– 5	.964
40	– 20	.953
50	– 35	.936

During the recent cold spell I became worried about the radiator of my automobile, and with good cause. The temperature in my garage was down to three degrees below zero. Although the solution in the radiator was liquid, a couple of hose connections under the hood were solid. I thawed these out with hot water on the outside, ran the engine and warmed things up. I took the specific gravity of the solution in the radiator and found it to be .975, a solution which should freeze at 10 degrees above zero, according to the above standard table. I could not understand why my radiator hadn't frozen solid.

A friend of mine gave me an explanation which I believe to be the correct one.

In chemistry, when a salt crystallizes out of a solution, the crystals of the salt are pure, no matter what impurities may have been in the solution. An example of this is a hot concentrated solution of copper sulfate, with some ordinary table salt also dissolved in it. On cooling pure crystals of copper sulfate will form; the table salt will stay in solution. A similar case is the freezing of an alcohol-water solution. Here the water crystallizes out as pure ice, while the alcohol stays in liquid form, but occluded in the ice. At the freezing of the ice, some of the alcohol is squeezed out to make room for the increased volume. This alcohol increases the percentage of the remaining solution, thereby lowering its freezing point.

This accounted for the fact that the solution in the upper part of the radiator was liquid, while the lower hose connections were filled with ice. I was surprised to find on thawing out my engine that nothing leaked. This I believe to be explained by the fact that the ice, on expanding, merely pressed out some of the occluded alcohol instead of bursting my radiator tubes. I know several other motorists who, having had similar experiences in the past severe cold spell, cannot understand how they came to escape serious damage to their machines.

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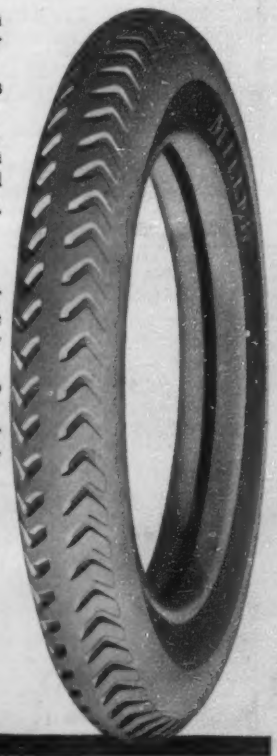

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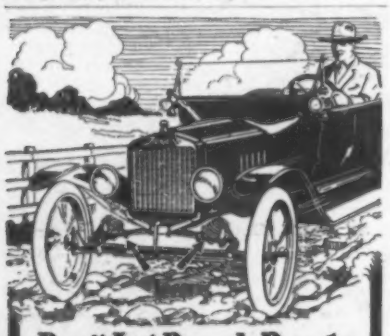

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Those who are interested in the trade opportunities listed in this column, can obtain the names and addresses by complying with the following simple rules: 1. Write only one inquiry on a sheet. 2. Always give the serial number. 3. Write on your own business letterhead. The SCIENTIFIC AMERICAN assumes no responsibility for the financial standing of concerns or individuals. Address all communications to the Query Editor of the SCIENTIFIC AMERICAN, Woolworth Building, New York.

770.—A firm in Algeria wishes to buy nails of all kinds, machine bolts, and garden tools, such as spades, rakes, hoes, etc. It also desires to secure an agency for the sale of agricultural machinery, such as mowing machines, hay rakes, hay presses small gas and gasoline engines, sisal cord for harvesting machines, and wire for baling hay. Correspondence should be in French. Reference.

771.—A man in Switzerland desires to represent American manufacturers and exporters of cottenseed oil. Payment will be made by cash against documents. Correspondence should be in French, if possible, otherwise in English. Reference.

772.—A company in Portugal is in the market for cement. Quotations should be made f. o. b. New York. Payment will be made by opening credit in New York. Correspondence may be in English. References.

773.—A man in Switzerland desires to purchase complete machinery and equipment for the treatment of medicinal herbs. Correspondence should be in French or Russian.

774.—A business man in Egypt is in the market for 300 dozen skins each, for making shoes, of leather, glace kid, patent leather, cossack hides, high-class veal and box calf in colors and black. Quotations should be made f. o. b. New York. Payment will be made by cash upon receipt of goods. Correspondence may be in English. References.

775.—A contractor in France wishes to buy molds for making concrete walls, elevators, and automatic pumps or distributors for concrete, and machines for tamping concrete. Payment will be made by cash against documents. Correspondence should be in French.

776.—A company in Honduras desires to secure agencies for the sale of American products in Honduras, Nicaragua, and Salvador through branch offices and traveling salesmen. Quotations should be made f. o. b. New York and New Orleans. Usual credit terms are desired. Correspondence may be in English. References.

777.—A firm in England is in the market for mailing machines, woodworking machinery, and machinery for making brushes of all kinds, including paint brushes. Payment will be made by cash against documents or by opening credit. Goods should be securely packed for transportation. References.

778.—A man in Portugal desires to purchase sulfur. Quotations should be made f. o. b. New York. Payment will be made against documents. Correspondence may be in English. References.

779.—One of our correspondents in Bombay, India, is in the market for small lathes, small drilling machines, etc., in fact, all tools such as are used by manufacturers of dental instruments, surgical instruments and devices for the relief of orthopedic deformities.

780.—Another correspondent in Bombay is in the market for sole agencies for automobile tires, boots and shoes, coal tar dyes and colors of all kinds, iron wood screws, wire nails and wires of all kinds, and bolts and nuts, and leather belting. He states that he is in a position to handle any manufacturer's goods for almost any line. He gives bank references.

781.—A correspondent in Brazil is in the market for two or even three all steel cotton compresses worked with oil engines and pumps complete. The duties of the press would be to make bales of at least 400 pounds weight, to have a density of not less than 40 pounds, to the cubic foot and to be capable of turning out 45 pressed bales per hour.

782.—A man in China desires to be placed in communication with American manufacturers and exporters of leather of all kinds, printing and writing paper, electric wires, cheap passenger automobiles, motorcycles, motor-car accessories, tires, agricultural machines, gasoline motors, typewriters, and sewing and knitting machines, hand or motor, for cotton, silk, and linen. He wishes to represent firms handling these goods. Correspondence should be in French. References.

783.—A firm in France wishes to purchase paper of all kinds. Quotations may be made f. o. b. New York. Correspondence may be in English. References.

784.—A creamery company in Canada is in the market for machinery, cans, etc., suitable for creamery purposes.

785.—An agency is desired by a company in England for the sale of toys and dolls. Payment will be made by letter of credit. Reference.

786.—A man in Venezuela who intends to establish a sole-leather tannery desires to be placed in communication with consulting engineer firms for designing and equipping tanneries and tanners' machinery. Catalogues and price lists of such machinery, tools, materials, and supplies should be submitted. References.

787.—A company in Abyssinia wishes to buy 2,000 bales 3-yard per pound gray sheetings; 2,000 bales 3.25; 2,000 bales 3.50; 1,000 bales, 3.90; and 1,000 bales 3-yard per pound gray drills. Payment will be made by cash against documents. Correspondence may be in English. References.

788.—A man in England desires to represent American manufacturers and exporters of groceries, nuts, peas, beans, etc. He is also willing to purchase goods on his own account if necessary. Payment will be made by cash against documents. References.

789.—A company in Switzerland is in the market for 30 short tons (30,000 kilos) net of rosin as used in the manufacture of soap. Payment will be made against documents in New York. Correspondence should be in French. References.

790.—A city in Chile desires to purchase a crematory for refuse for a city of about 25,000 population; automobile street-sweeping machine to be used on cobble pavements; automobile ambulance of the latest military model adopted by the United States Army; automobile troop carrier; automobile street sprinkler; and spare parts and accessories for all kinds of automobiles. Quotations may be made f. o. b. New York or factory. Orders for the above articles will be sent by cable through local bank which will settle all bills, etc., thus avoiding all delays. Correspondence may be in English, but Spanish is preferred.

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The value of the sturdy, economical Federal, therefore, is not to be measured alone in terms of the profits you earn, the business you dispatch, the greater distance you cover. Its value must also be measured in terms of human advancement and national growth.

Write for "Federal Traffic News."

Federal Motor Truck Co., Detroit, Mich.

Redding, Cal.,
Oct. 24, 1917.

"When we purchased our first two Model "M" Federals, to put on the Redding Weaverville run, the people in that community and the freighters on the road, knowing its condition, ridiculed the idea of using motor trucks on it. It is a fact that the roads did look impossible for motor trucks, as there are thirty per cent grades, right angle turns, narrow places.

"We have the mail contracts between Redding, Shasta County, and Weaverville, Trinity County. The mail must go the year round, and no excuses are accepted. There is no railroad in Trinity County, and it is said that there are children there fifteen years of age that have never seen a wheeled vehicle. There are very few roads there, most of the transportation being over trails. Mail includes parcel post, and parcel post includes everything.

"It takes an eight-horse team seven days to make the round trip from Redding to Weaverville, hauling five tons one way and it costs at least $10.00 per day to feed the team, and $4.00 a day for a driver, making a total of $98.00 expenses for moving five tons the distance, which is fifty-two miles.

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"We ran our trucks over this impossible road all last winter, and they never failed us."

Redding-Weaverville Stage Co.

FEDERAL

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